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An Analysis of Cooperative Over-Order Pricing of Fluid Milk

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Abstract

Dairy cooperatives apparently do not have unfair price advantages in federally regulated milk markets. Because 80 percent of dairy farmers belong to cooperatives, some analysts feel that these organizations could enhance earnings by charging milk handlers high prices for nonprice-regulated services (over-order premiums). However, the probability of cooperative abuse of market power is limited because milk handlers would likely reject too-high premium prices; the availability of milk from outside the cooperative area would blunt cooperative control; and shortrun gains from high premiums would erode if producers respond to high consumer prices by producing more milk, which would generate surpluses and then reduce prices.

Keywords: Cooperatives, marketing orders, milk pricing, monopolization.

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Contents

Summary

Milk cooperatives do not appear to exercise market power consistently in federally regulated milk markets. Market power is the ability to control supply and elevate prices above competitive levels. Some critics have claimed that cooperatives can achieve monopoly gains from fluid milk handlers by negotiating prices for fluid milk above those specified by the Government in Federal milk marketing orders (over-order premiums). These critics assert that the ability of cooperatives to negotiate such premiums is related to the size of their market share. This study shows that when adjustments for factors other than market share are made, there is not a strong, consistent relationship between the market share of leading cooperatives and the level of over-order premiums in these markets.

The study reveals a relationship between over-order payments and competitive pressures. Class I price differentials, which are order-specified differences between fluid and manufactured milk prices, have remained constant since 1968 and amount to less than half of actual transportation costs among markets. Consequently, even in markets with large surplus milk supplies, which are sources of reserve supply, order minimum prices may be inadequate to pay for moving milk to major regions of consumption. Over-order payments become, then, necessary to stimulate milk shipments.

Another competitive factor that produces over-order payments is the transfer of service functions from fluid milk handlers to milk marketing cooperatives. This especially applies to balancing available supply with fluid milk needs across markets. Evidence from other studies (supported, in part, by this report) indicates that cooperatives can provide this service below the cost that the individual handler would incur. So, handlers would be expected to contract with cooperatives for the balancing service by paying an amount beyond the order minimum Class I price.

Pricing imperfections can also yield prices paid above the minimum level. Class I prices are determined by the Minnesota-Wisconsin (M-W) manufacturing milk price (what manufacturing plants pay for milk in those two States). The established price in a given market for a particular month is based on prices from 2 months before, so the potential exists for negotiating a premium based on *anticipated* price. (An increase in the M-W price creates a larger premium, and a price decrease results in a lower or zero premium.)

The authors conclude that the complexities and dynamics of pricing in Federal milk marketing orders cannot be captured and measured by conventional regression analysis. More exact theories of pricing in milk cooperative markets are needed before the cooperative market power issue can be properly examined.

An Analysis of Cooperative Over-Order Pricing of Fluid Milk

Edward V. Jesse
Aaron C. Johnson, Jr.*

Introduction

Federal milk marketing orders and farmer marketing cooperatives are interrelated in the marketing and pricing of Grade A milk in the United States. More than 80 percent of Grade A milk is marketed under Federal order regulations. Each order establishes the minimum price of milk to be paid by regulated handlers for each use-classification. In recent years, more than 80 percent of dairy farmers delivering milk to Federal order markets have been members of marketing cooperatives, who bargain with handlers for price and other terms of trade, and manufacture surplus Grade A milk not needed for fluid use. In addition to bargaining, cooperatives provide a number of other services, such as milk hauling and quality control, to their farmer-members.

Cooperatives have been instrumental in initiating and implementing Federal orders, primarily by developing proposals for order provisions and by presenting testimony at order hearings on behalf of farmer-members. Existing legislation gives cooperatives some special treatment. Cooperatives may vote their membership as a bloc on order referenda. They are not required to return the announced order minimum blend price to their members, and they may reblend receipts from the different markets in which they operate.

Because of this historical and institutional relationship, many argue that marketing orders tend to bestow market power on cooperatives, with the minimum prices established by the orders serving as the base for negotiations between cooperatives and milk handlers. The source of this power, it is argued, arises from several provisions of the order program, which cooperatives have supported. The treatment of other-source milk under the orders diminishes the ability of handlers in one market to obtain less costly milk from other markets, whether regulated or unregulated. Reblending privileges allow cooperatives to overpay the minimum order blend price in some markets, thus attracting members from among independent producers and thereby reducing the cooperatives' competition. Order auditing procedures and related market information dissuade handlers from concealing price-cutting activities.

Whether cooperatives actually possess market power and, if they do, whether they exercise it is quite another matter. Much of the debate on this issue is rooted in the fact that no universally accepted empirical measure, or indicator, of market power exists. Over-order premiums, payments by handlers to cooperatives on Class I sales (and sometimes Class II or III sales) above order-specified minimum prices, are often cited as evidence of cooperative market power. Critics of cooperatives charge that premiums indicate monopolistic pricing by cooperatives and, as a consequence, cooperatives violate the Capper-Volstead Section 2 proscription of undue price enhancement (*12, 15, 17, 18*).[1] Supporters of cooperatives counter that premiums indicate competitive price adjustments over artificially low minimum order prices, or that cooperative market power merely countervails the market power of handlers (*9, 11, 19*).

*Jesse is an agricultural economist and Johnson is a professor in the Department of Agricultural Economics, University of Wisconsin, Madison.

[1]Italicized numbers in parentheses cite sources listed in the References section.

This study focuses on what over-order premiums represent, whether they manifest monopoly control of milk markets by dairy cooperatives, or whether they are a means of achieving competitive pricing in Federal milk marketing orders. This is not a new area of empirical research. The relationship between over-order premiums and cooperative market power has been studied by others with conflicting results. This report's contributions include refinements in statistical methods, definitions of variables, and disaggregation. No new theory of milk pricing under Federal marketing orders is offered and tested.

The approach identifies factors likely to influence the level of over-order premiums and estimates their individual and combined effects. Monthly data are used, permitting examination of possible seasonal and other within-year effects. The period used is 1973-80, a time of substantial month-to-month variability in premiums across the 38 Federal marketing orders included in this study.

Cooperative Involvement In Fluid Milk Marketing

Cooperatives strongly influenced fluid milk marketing long before passage of marketing order legislation.[2] Before the widespread use of farm bulk tanks in the late 1950's, cooperatives mainly bargained. Processors assembled fluid milk, or arranged for pickup, and also handled the excess.

Background

Cooperatives increased their assembly and balancing role in the 1960's and 1970's when many processors built specialized plants and began to rely on cooperatives to provide milk as needed. This obligated cooperatives to assume responsibility for manufacturing surplus milk and providing other services to producers that were previously provided by proprietary processors. Many local cooperatives merged into larger regional units, partly to achieve the size necessary to supply these large specialized processors.

Cooperatives provide both producer and marketwide services.[3] Producer services include helping individual members with production and inspection problems, retirement and insurance programs, hauling and negotiating rates, and assuring a daily market. Marketwide services benefit both producers and processors. In some cases, such as manufacturing milk in excess of Class I use, all producers in a market benefit whether or not they are affiliated with the cooperative providing the service. This free-rider problem has prompted some cooperatives to seek marketing order amendments to require payment for these services from pool proceeds.

In 1980, about 84 percent of the producers shipping fluid milk under Federal orders were members of cooperatives, the same as in 1960. Cooperative member deliveries in 1980 as a proportion of total order receipts also totaled 84 percent, indicating that members and nonmembers are of equal size. In December 1980, 196 cooperatives operated in the 38 orders east of the Rocky Mountains. The number of cooperatives per order ranged from 1 in seven markets to 73 in the Upper Midwest order.

Most of the 196 dairy cooperatives were local, and 164 operated in only one market. Four cooperatives served more than five markets. One of these four was the National Farmers Organization (NFO), which is essentially a bargaining agent. The other three, Associated Milk Producers, Inc. (AMPI), Mid-America Dairymen (Mid-Am), and Dairymen, Inc. (DI), are large, regional cooperatives that operate receiving and manufacturing facilities and provide numerous producer services in addition to bargaining.

AMPI, Mid-Am, and DI are the result of the merger of numerous smaller local cooperatives. AMPI operates in a broad geographical area stretching from Minnesota to Texas and from Colorado to Indiana, showing the highest membership percentage in the Southwest. Mid-Am operates in a similar area but is concentrated in the midsection of the country. DI members are primarily in the Southeast. In contrast to AMPI, Mid-Am, and most other dairy cooperatives, DI is heavily involved in processing and distributing fluid milk under its own and others' labels.

These three large regional dairy cooperatives have been the focus of much of the debate surrounding market power and over-order premiums. Each has been charged by the Justice Department with anti-

[2]See (16) for an expanded discussion of the history of cooperatives in marketing fluid milk.

[3]See (1) for a list of 11 producer services and 14 marketwide services typically provided by dairy cooperatives.

trust violations.[4] Each earned more than $1 billion in 1982 (table 1).

Incidence and Magnitude of Premiums

Negotiated over-order premiums in fluid milk markets date back to 1956 when a change in seasonal pricing provisions under Federal orders was accompanied by a number of cooperatives obtaining premiums as a way of maintaining price relationships that existed before the change. Before 1956, premiums existed primarily in markets where State regulatory bodies set prices above order minimums. The number of Federal markets with premiums increased gradually through the 1950's, reaching about 65 percent of all markets by 1970 and increasing to over 90 percent of all markets in 1975 where it remained through 1980 (table 2).

Simple average (38-market) monthly premiums for 1973-80 appear in figure 1. Premiums rose dramatically and fell just as dramatically between 1973 and 1975. This situation paralleled the price pattern in the overall agricultural sector during 1973-75, a period when a number of exogenous shocks, such as the oil embargo, large Russian grain purchases, and devaluation of the dollar, hit farm markets. Since early 1976, annual premiums have followed the general inflationary trend.

The Economic Function of Premiums

Proponents of cooperatives tend to defend over-order premiums as a natural response to competitive market forces or as a reflection of imperfections in the price discovery process. Critics of marketing orders argue that premiums reflect market power of large dairy cooperatives. These positions are reviewed below.

Competitive Market Forces

In the early history of Federal orders, high perishability made fluid milk markets very local in nature. Consequently, Class I prices were based solely on local supply and demand conditions with prices established to assure an adequate local supply of milk. Because of this localized nature of fluid milk markets, the aggregate U.S. production/consumption balance hardly affected order prices.

In the post-World War II period, improvements in refrigeration and transportation gradually broadened raw fluid milk markets in the sense that potential supplies to handlers were available from greater distances. Pricing provisions in Federal orders were changed as markets for fluid milk became larger than the areas defined in marketing orders. The major change was instituting a spatial price adjustment, using Class I price differentials, across Federal orders, with the Upper Midwest milkshed as the basing point. Class I differentials, which have remained virtually unchanged since 1968, increase linearly at the rate of about 14 cents per hundredweight (cwt) per 100 miles from the differential at Eau Claire, Wis., the base point.

For the structure of minimum Class I prices established by using single basing point differentials to produce a competitive spatial price surface for fluid milk, the following conditions must hold: (1) the

[4]The AMPI and Mid-Am suits ended with consent decrees. DI was essentially exonerated.

Table 1—Financial highlights for leading multiregion dairy cooperatives, 1982[1]

Cooperative	Members	Member milk deliveries	Revenue	Net margin	Assets	Member equity
	Number	*Billion lbs.*	*Million dollars*			
AMPI	26,400	15.7	2,592,111	7,647	364,439	106,131
Mid-AM	11,587	6.7	1,224,288	8,507	281,906	94,805
DI	8,005	6.4	1,152,430	14,755	247,778	82,939

[1]Calendar year 1982 for AMPI and Mid-Am; year ending Aug. 31, 1982, for DI.

Source: Corporate annual reports.

price slope must equal the actual transportation cost, (2) each fluid milk market outside the basing point must be in balance or deficit (not in surplus), and (3) the basing point market must have sufficient fluid milk surpluses to satisfy aggregate milk shortages in other markets. In fact, none of these conditions holds, and they cannot hold in the face of changing economic conditions and constant Class I price differentials.

The order minimum price slope of 14 cents per cwt per 100 miles is less than half of actual transportation costs. Moreover, Grade A milk deliveries by farmers beyond Class I needs, including an operating reserve, are observed in several markets. In other words, surplus markets exist elsewhere than in the Upper Midwest. Consequently, based on the theory of competitive spatial price relationships, prices in deficit markets should be above order minimum prices (premiums would exist), and might be above minimum prices in surplus markets, depending on the nature of the market's supply and demand curves. Such premiums could, of course, be temporary, reflecting shortrun aberrations in supply

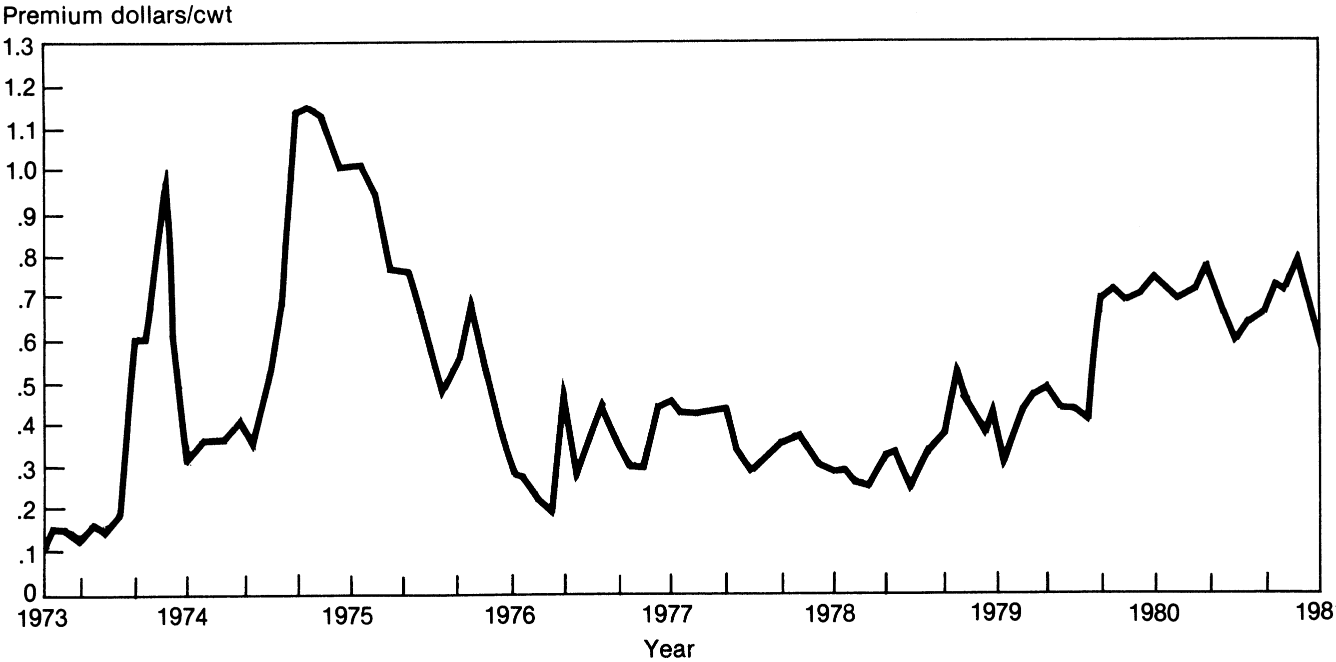
Table 2—Number of Federal milk marketing orders with over-order premiums, and size of premium, 1956-80

Year	Federal orders[1]	Orders with Class I premium[1]	Percentage of orders with premiums	Weighted average of annual Class I premiums	Premium as a percentage of minimum Class I price
	---------*Number*---------		*Percent*	*Dollars/ cwt*	*Percent*
1956	68	3	4.4	NA	NA
1957	68	12	17.6	NA	NA
1958	74	13	17.6	NA	NA
1959	77	12	15.6	NA	NA
1960	80	29	36.2	NA	NA
1961	81	24	29.6	NA	NA
1962	83	28	33.7	NA	NA
1963	82	30	36.6	NA	NA
1964	77	28	36.4	NA	NA
1965	73	23	31.5	NA	NA
1966	71	24	33.8	0.28	5.0
1967	73	30	41.1	.33	5.6
1968	73	40	54.8	.26	4.2
1969	67	40	59.7	.28	4.3
1970	62	40	64.5	.20	3.0
1971	62	38	61.3	.22	3.2
1972[2]	62	22	35.5	.13	1.8
1973[2]	61	25	41.0	.32	4.0
1974	61	46	75.4	.66	7.1
1975	61	57	93.4	.60	6.4
1976	52	48	92.3	.30	2.8
1977	47	43	91.5	.31	2.9
1978	47	44	93.6	.31	2.7
1979	47	45	95.7	.44	3.4
1980	47	44	93.6	.54	3.9

NA = not available.
[1]As of June for 1956-74; as of July for 1975-80.
[2]Discussions with personnel from the Agricultural Marketing Service revealed that a temporary change in the definition of Class premiums occurred in 1972 and 1973. Specifically, the premiums reported in these 2 years are net of reported service charges. Data were not available to make columns comparable across all years.

Figure 1

Monthly Over-Order Premiums, Simple Average, Including 38 Markets, 1973-80



or demand conditions, or they could be chronic in markets where production costs are relatively high. The upper limit on premiums relative to spatial alignment depends on transportation costs and on prices in markets with surplus fluid milk.

Another competitive force that may induce premiums is the transfer of service functions from fluid milk handlers to cooperatives. If a handler deals directly with producers in procuring milk supplies, the handler must incur all procurement costs, such as providing field services, check writing, and disposing of milk not needed for bottling (balancing). The handler can avoid these costs by contracting with a cooperative for milk as needed. If the price (in the form of a negotiated over-order premium) the handler pays for having the cooperative provide these services is less than the handler's own cost of providing them, then the handler would be expected to contract with the cooperative. This would be the case whether or not the administered Class I price was the so-called competitive price.

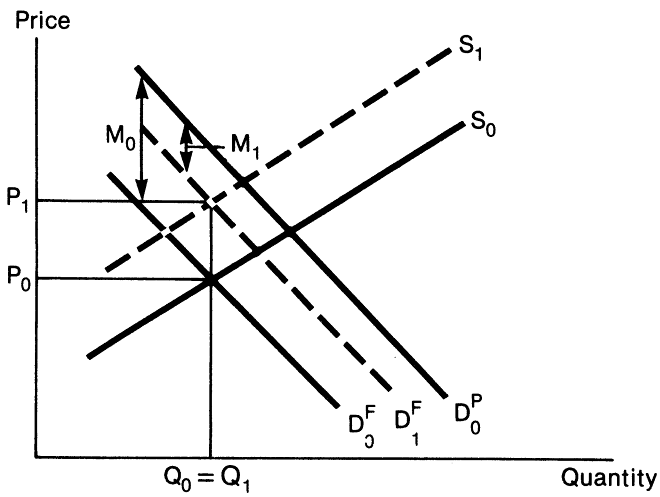
Service-function transfers are depicted graphically in figure 2 under the assumption that the administered Class I price is the competitive price. D^p_0 represents the processors' derived demand for fluid milk and D^f_0 is the farm level demand. The horizontal difference between D^p_0 and D^f_0 (shown to be constant) is the processor margin equal to M_0, if handlers procure milk directly from producers. Aggregate farm level supply is shown as S_0 initially, yielding an equilibrium farm price of P_0 and quantity Q_0.

If handlers contract with a cooperative for fluid milk, the margin would decline to M_1, reflecting the decrease in procurement costs to handlers, and farm level demand would thus increase to D^f_1. Aggregate supply would shift leftward (to S_1) by the amount of the increase in cost to farmers (via their cooperative) related to their providing the procurement functions previously performed by the handlers. The new equilibrium occurs at a higher farm price (P_1). If P_0 is the order-administered price, then P_1–P_0, an over-order premium, is a payment by handlers to a cooperative for procurement services provided by the cooperative.

While no change in equilibrium quantity is shown in figure 2, the expected change would be greater than

Figure 2

Effect of Transferring Procurement Functions From Handlers to Cooperatives in a Competitive Fluid Milk Market



Variables:
P = farm-level fluid milk price
M = fluid milk processor margin
S = farm-level fluid milk supply
D = fluid milk demand

Superscripts:
F = farm level
P = processor level

Subscripts:
0 = procurement performed by processor
1 = procurement performed by cooperative

or equal to zero. A negative change in quantity could occur only if the cooperatives' service charge is greater than the handlers' internal procurement costs. In that case, handlers would not likely contract for services unless they were coerced. Whether equilibrium quantity increases, that is, whether cooperatives can provide procurement services at a lower cost, depends mostly on the number and size of cooperatives compared with handlers. For example, a large cooperative that supplies milk to several handlers with different bottling schedules should be able to balance Grade A deliveries and Class I needs among handlers more efficiently than each handler acting independently.[5]

[5]See (14) or (8) for a discussion of balancing economies associated with volume.

Pricing Imperfections

Pricing imperfections refer in this report to the time lags involved in adjusting order minimum prices. The Class I price mover in Federal orders is the manufacturing (Grade B) milk price paid by Minnesota and Wisconsin (M-W) manufacturing plants. The minimum Class I price in a given market for a particular month is set at the manufacturing price (the M-W price) lagged 2 months plus the Class I differential for that market. Because of this 2-month lag, the M-W price is known before it is used to establish the Class I minimum price in a market. The potential exists then for negotiating on the basis of anticipated prices, that is, an increase in the M-W price resulting in a larger premium, and a decrease in the M-W price resulting in a lower or zero premium.

Sticky prices at the retail level, combined with the lagged adjustment in the Class I price, may also give rise to premiums. For example, if the minimum Class I price is scheduled to fall and handlers believe the decline will be temporary, they might prefer not to disturb their selling prices, in which case they may be willing to pay the old Class I price. This could create over-order payments or could increase existing payments. Such payments would, of course, become increasingly tenuous if the Class I price fails to rebound.

Market Power

The argument that market power induces over-order premiums is the traditional one. In markets with a large cooperative, or a small number of moderately large cooperatives coordinating their activities, the ability to control the supply of fluid milk to handlers provides the cooperative(s) an opportunity to exact an above-market price. That such prices exist in the form of over-order payments is taken as evidence that the potential market power is indeed exercised.

Limits, however, restrain a cooperative's possession of and ability to use market power. First, cooperative market power can be counteracted by the market power of handlers. All else constant, premiums would be smaller if cooperatives faced fewer buyers (13). Second, the availability of Grade A milk supplies outside the orders in which a cooperative operates limits its power to control price within the order. Handlers' procurement of raw fluid milk is not limited to the geographical area defined by a marketing order. Milk flows among orders in response to relative prices. Intermarket transfers include spot purchases by regulated handlers from supply plants in other orders and from producers in unregulated areas. Also, Grade A producers may be pooled in markets outside their normal supply area; for example, orders do not preclude a Wisconsin Grade A dairy farmer from shipping milk to a handler regulated under the southeastern Florida order.

Yet, the marketing areas defined by orders appear to be reasonably relevant markets in the context of defining market power. There are economic barriers to moving outside-order raw fluid milk into an order marketing area. The primary barrier is transportation costs for the bulky, perishable product. The down-allocation and compensatory payment provisions in Federal orders also favor the use of local milk over imported milk. In addition, cooperatives have used a standby pooling arrangement to reduce the incentive of unpooled plants shipping milk into regulated markets.

Another constraint on the market power of dairy cooperatives is their inability to control the milk production of their members. Shortrun gains in the form of higher premiums would erode if producers responded to higher prices by producing surpluses that yielded lower utilization rates and reduced blend prices. This potential response to higher premiums may deter the seeking of higher premiums in the first place.

Previous Research

Economic studies of over-order premiums have emphasized the market power rationale, with conflicting conclusions regarding the relationship between premiums and cooperative market shares in Federal order markets. A 1977 Justice Department report (15, p. 88) on milk marketing orders and dairy cooperatives concluded:

> For the years 1973-75, the level of significance of positive association between concentration and premiums is one in ten thousand. This correlation between the market share held by the dominant cooperative and the size of the premium extracted strongly indicates that over-order charges relate more to control of Class I (graded) eligible milk in an order, than to the level of services provided.

This conclusion was based on a Chi-square test of the simple correlation between premiums and market share, which did not control for the possibility that factors other than market share might affect the level of premiums.

Masson and Eisenstat (*17*) examined one southern market in which the largest regional cooperative, AMPI, was the dominant market. The objective of the research was to measure the effect of the 1975 consent decree of the Justice Department on premiums in the market. Premiums were regressed on Class I utilization, Class I price, indexes of fuel and feed costs, a dummy variable indicating lifting of price controls, and a dummy variable for the signing of the consent decree. The researchers concluded that the net effect of the decree was to lower AMPI's premiums in the market by more than 50 cents per cwt. The estimated equation, however, may not have adequately controlled for the dramatic decline in premiums in all Federal order markets which occurred at exactly the same time (see fig. 1).

In 1976, USDA published a study that addressed whether the high level of over-order premiums during 1974-75 represented undue price enhancement under the Capper-Volstead Act. Premiums in 53 markets east of the Rocky Mountains were regressed on (1) distance of the order market from Eau Claire; (2) price alignment, defined as the amount by which the order minimum price deviated from a predicted price based on distance of the market from Eau Claire; and (3) various measures of cooperative concentration in the order markets. Cross-section equations were estimated for calendar years 1974 and 1975 and for marketing years (July-June) 1974-75 and 1975-76. The study concluded:

> Considering the national average picture, there is no evidence that cooperative actions in obtaining over-order payments in 1974-75 results in prices that were too high for economic conditions. The economic

> evidence confirms the contention of the cooperatives that the sharp increase in over-order payments in this period reflected their effects to offset the sharp cost-price squeeze on their members, the producers. (*20*, p. 53)

However, the study identified 14 markets in which negotiated premiums were unusually high relative to expectation based on the economic analysis. In seven of these markets, DI was the dominant cooperative, accounting for 65 to 100 percent of all producer receipts. In two markets, a State regulatory agency established prices above the order minimums. Three of the markets were in Florida, where three cooperatives jointly allocated milk supplies among handlers. The remaining two markets were southern Michigan and Chicago, markets with common marketing agencies who negotiate prices for member cooperatives.

Studies by Babb and his associates (*2, 3, 4, 5*) have examined the effects of a number of factors on over-order premiums:

- Cooperative (seller) concentration
- Processor (buyer) concentration
- Price relationships among Federal orders
- Class I utilization
- Returns above direct costs of milk production
- Barriers to the movement of raw milk

Alternative measures of cooperative concentration used in these studies were market share of the largest cooperative, market share of the four largest cooperatives, and market share of all cooperatives. The variable, price relationship among orders, was measured as minimum Class I price minus the estimated Class I price based on distance from Eau Claire (Class I deviation), and as minimum Class I price minus Chicago order Class I price at Eau Claire plus transportation from one of four Midwest base points (alternative cost of milk). Processor concentration measured as the four-firm market share was available for only a limited number of years. Barriers to the movement of raw milk were specified as an index value with a 0-to-100 range; this variable was available to the researchers for only 1 year.

Annual cross-section equations for each year from 1965 to 1980 using only those orders in effect in any year were estimated to measure the effects of the variables mentioned above on Class I premiums and on the difference between Class I and Class II premiums. Pooled regressions with order and time intercept shifters were also estimated using only orders in effect for the entire 16 years. Babb and Bessler concluded:

> The estimated coefficients for processor concentration were generally not significantly different from zero and their impacts on the level of over-order payments were small. Cooperative concentration was also found to have little or no impact on differences in over-order payments for fluid and nonfluid uses. On the other hand, the coefficients for measures of price relationships among federal orders was highly significant and accounted for much of the variation in over-order payments. The analysis of pooled data revealed significant differences among intercept shifters for orders and for time periods. This suggests that factors not related to concentration may affect market power and over-order payments. The impacts of other economic variables were minor. These findings suggest that market forces are adjusting prices in federal milk orders as one would expect in spatially separate markets. (*4*, p. 2)

Capponi compared cooperative pay prices with order minimum blend prices to estimate the service charge component of premiums. In markets where cooperatives paid less than order blend prices, he judged premiums to be inadequate to cover the costs of services. Based on this comparison, Capponi observed that:

> Some critics have asserted that. . . "over-order prices" charged by cooperatives are too high. But they may be ignoring the additional cost of services (not covered by minimum prices) and increased transportation costs not reflected in the geographic structure of minimum order Class I prices. . . With few exceptions, over-order Class I prices have not brought about producer pay prices in excess of minimum blends. Consequently, they have not been a

significant factor in the recent increases in milk production in most areas. (7, p. 9)

Variables Used In This Analysis

The present study used monthly data for 1973-80. Because the number of marketing orders changed during this period, primarily because of market mergers, we constructed a set of 38 markets east of the Rocky Mountains. These correspond roughly to orders existing on January 1, 1984. By tracing back through the mergers, historical data for premerger markets were aggregated or averaged, as called for by the data, into the merged markets.

Over-Order Premiums

Over-order premiums used in this study were computed as the total value of Class I milk payments minus total value based on minimum Class prices divided by total Class I volume. Hence, premiums are defined as weighted averages across cooperatives operating in a market, where the weights are cooperative Class I sales. No distinction is made between over-order payments designated as service charges and other handler payments to cooperatives. The potential effect of State price controls on over-order payments is ignored.

The unpublished premium data were provided by the U.S. Department of Agriculture's (USDA) Agricultural Marketing Service (AMS), Dairy Division. Missing data required us to modify certain specifications. Eight noncontiguous missing premium values (seven in south central markets for February 1976) were replaced by the means of adjacent monthly values. Some markets had several missing premium values before May 1973. The series were truncated to the 92-month period from May 1983 to December 1980 in specifications that required equal-length series. Two markets had no reported premium data for much of the sample period: New York-New Jersey until November 1978 and eastern Colorado until November 1974. These two markets were deleted in most time-series specifications. Other data adjustments, including procedures for combining premerger markets, appear in the appendix.

Variables Measuring Competitive Forces

In principle, a competitive spatial price surface for Class I milk can be estimated and compared with order-administered Class I minimum prices. In practice, such an approach involves the formidable task of estimating supply, demand, and transfer cost functions for each of 38 markets. Another, less complicated approach used here is to incorporate directly variables which reflect competitive forces in a regression equation. The variables used in this study measure overall supply-demand balance, supply curve shifts, changes in transportation costs, and balancing costs.

Supply Relative to Demand. Other things constant, premiums would likely be smaller when the supply of Grade A milk available to a market becomes larger.[6] While local market supplies may have the stronger influence on premiums, excess aggregate supplies in the marketing system will put downward pressure on minimum Class I prices through their effect on the M-W price and on premiums to the extent that surplus milk is shipped to deficit markets.

Net monthly Commodity Credit Corporation (CCC) removals in raw milk equivalent units measured aggregate supply-demand balance. Removals are positive when the CCC purchases cheese, butter, and nonfat dry milk and negative when these products are released back into commercial channels. Class I utilization (Class I use as a percentage of deliveries) measured individual market supply-demand balance. We also experimented with various measures of surplus (Grade A deliveries in excess of fluid needs).

Neither the aggregate nor the market supply-demand balance variables were statistically significant in explaining premium levels. While a negative simple correlation exists between premiums and Class I utilization averaged over time, this relationship is masked in the monthly formulations, probably

[6]Note that demand for Grade A milk includes manufacturing as well as fluid handler demand. Thus, a strong cheese demand in a particular market might result in higher premiums even though fluid demand in the market is constant.

because of intercorrelation among explanatory variables. In any case, we elected to exclude measures of surplus, either individual market or U.S. aggregate, from the estimates discussed here.

Direct Production Costs. Some have argued that over-order premiums represent increases in the direct cost of producing milk which are not adequately reflected in the existing price structure. We tested this proposition using a direct cost variable (D1COST) constructed on the basis of the 1979 cost-of-production survey for milk conducted under congressional mandate by USDA's Statistical Reporting Service (SRS). These base data, projected backward and forward in time from 1979, use monthly State SRS price data for hay, grains, and concentrates, monthly State SRS labor rates, and annual SRS estimated feeding rates for dairy cows. Counties and States were combined to the extent possible to represent appropriate marketing order areas. The appendix contains a description of the specific data and computations used to construct D1COST.

Direct production costs are expressed as monthly first-differences, that is, as the month-to-month change in cost.[7] The expected sign of D1COST is positive. As the supply curve shifts to the left, indicated by an increase in production costs, competitive conditions call for an increase in the equilibrium price, all else being constant. If that increase is not forthcoming through the order system, over-order premiums could be the result.

Alternative Cost of Milk Supplies. Some studies show that the amount that minimum Class I prices are below the cost of procuring milk from surplus milk areas is an important determinant of the level of over-order premiums (*4*, *20*). Care should be taken in interpreting this difference (cost minus minimum Class I price). It could, of course, represent competitive pricing, or it could also represent limit pricing, feasible if cooperatives exercise market power. Competitive pricing would yield premiums equivalent to alternative milk cost minus order minimum prices only in markets where the resulting effective price is too low to induce market self-sufficiency. Premiums accompanied by a chronic excess of local supplies of Grade A milk would indicate limit pricing.

Following the example of Babb, we measured the alternative cost of Class I milk for a particular market as the minimum order Class I price in one of two markets with large Grade A surpluses (Chicago or New York) plus the cost of shipping milk from whichever of the two markets carried the lowest value. We then defined the variable, LIMMIN, as the alternative cost to a particular market minus the minimum Class I price in that market.

LIMMIN has several shortcomings as a measure of competitive spatial price adjustments. First, it does not by itself distinguish between competitive price adjustments, attributable to a misalignment of minimum prices across orders, and monopolistic limit pricing. However, in combination with structural variables in the regression equation, the coefficient of LIMMIN might be interpreted as a net competitive effect.

Second, the alternative sources of supply and the prices used in constructing LIMMIN are somewhat arbitrary. Milk required immediately in a deficit area is not likely obtained from a distant surplus area. Rather, the deficit market obtains needed supplies from a nearby market, which in turn replaces the milk from another nearby market. This continues until some market eventually draws supplies from the surplus area.[8] Finally, the effective prices for out-of-order milk include a premium and should be adjusted for additional costs imposed on handlers by the down-allocation provisions of the order.

Balancing Costs. As noted above, cooperatives may be in a position to provide a balancing service at a cost equal to or lower than that which would be incurred if handlers did their own balancing. An over-order premium could be payment for balancing.

The need for balancing is rooted in the contraseasonal patterns of milk production and milk consump-

[7]Expressing the direct production cost variable as a first-difference may appear statistically inappropriate given that the dependent variable is measured as an actual value. Our defense is a pragmatic one. The nature of direct production costs differs among regions, lending more confidence to changes than levels (see appendix). Also, expressing costs as a first-difference makes this variable consistent with other economic variables, which are measured as deviations.

[8]See (*14*, pp. 25-26) for a discussion of this "stairstep method" for moving milk.

tion. Because of this relationship, balancing Grade A milk supplies with fluid bottling needs is a complex and costly process in fluid milk markets. Balancing is normally done by cooperatives. The cost of balancing can differ substantially across markets, depending on utilization rates and market size. Besides seasonal balancing, irregular bottling schedules require weekly balancing as well. Few handlers process fluid milk on weekends, and many operate less than 5 days per week. Since we do not have data on weekly processing schedules, we are unable to consider their effect on premiums.

In high-utilization markets where no manufacturing outlets for surplus milk exist (Tampa Bay, for example), balancing involves obtaining out-of-market milk when Grade A production is short of needs and finding an out-of-market home for milk when local milk is temporarily in surplus supply. To a large extent, balancing means constantly transporting milk, either from surplus markets or to markets with excess processing capacity.

In low-utilization markets (Upper Midwest and Chicago regional, for example), many pooled plants are predominately manufacturing plants which normally supply fluid handlers only the amount of milk needed to meet the pooling requirements. Balancing costs are highest in the short-production season because these manufacturing plants must sacrifice profits by operating at a higher cost and a reduced scale to meet the needs of fluid handlers. In the flush season (when milk production hits its seasonal peak), balancing costs are not as high as those in high-utilization markets, unless manufacturing capacity is approached.

It is not clear how balancing costs should be measured for purposes of regression analysis. We tried a number of alternative empirical specifications. After considerable experimentation, we settled on two specific measures, one continuous and one dichotomous. The latter measure was a dummy variable for the flush season (April-June) and one for the short season (September-November) of milk production. The continuous balancing cost variable is:

$$\text{BALANCE}_{i,t} = \begin{cases} 1 - \dfrac{S_{i,t}}{\left(\sum_{i=1}^{12} S_{i,t}\right)/12} & \text{if } S_{i,t} < \left(\sum_{i=1}^{12} S_{i,t}\right)/12 \\ 0 & \text{otherwise,} \end{cases}$$

where $S_{i,t}$ is average daily producer deliveries in excess of Class I use during month i of year t.

In this computation, BALANCE takes on its minimum value when the market's surplus is at or above the annual average, and its value increases as local supply decreases relative to local demand. The maximum value of BALANCE is less than 1 in markets that are never in deficit; its value is unbounded in deficit markets.

Using BALANCE assumes that cooperatives providing the balancing service expect to dispose of some normal surplus, and that balancing costs increase as the surplus falls short of normal. Using BALANCE does not assume a symmetry of costs between flush and short production seasons in high-utilization markets. This may not be unreasonable, given that the problem of surplus disposal in high-utilization markets is a fairly recent phenomenon. Moreover, handlers may well prefer to pay premiums for supplemental milk and avoid making arrangements for the occasional disposal of unneeded supplies.

Variables Measuring Pricing Imperfections

Because the M-W price is the prime mover of order minimum prices and because there is a lag of 2 months between when the M-W price changes and when that change is reflected in the Class I price, some argue that over-order premiums reflect a form of anticipatory pricing. The variable ADJMWP, defined as the lagged first difference of the M-W price, was used in regression to capture this possibility (of anticipatory pricing). Over the period of the analysis, the monthly minimum Class I price in a particular market is the M-W price lagged 2 months plus the Class I differential for that market. For example, the minimum July Class I price is based on the May M-W price. Hence, at the time cooperatives negotiate a monthly Class I price, they know or can forecast the order minimum price for the following month because they know or can accurately guess the M-W price for the preceding month. Projected changes in the M-W price likely influence the cooperatives' ability to negotiate premiums. Handlers may be willing to tolerate part of an anticipated increase in the administered price before the fact but would likely resist a negotiated price increase in the face of an expected decline in the administered price.

A second variable, RATCHET, was used to capture the effect of sticky prices (prices that fail to respond to raw product costs) in milk distributing and retailing, especially during periods of falling minimum prices. RATCHET is the monthly order Class I price minus the previous maximum Class I price, if the current Class I price is below its previous maximum, and zero otherwise. Because of sticky prices, it seems reasonable that when administered prices are falling, cooperatives will redouble their negotiating efforts to hold effective prices, while at the same time handlers will not strongly resist higher premiums as long as their effective pay price does not increase.

Variables Measuring Relative Market Power

A review of previous studies revealed that researchers have measured cooperative concentration by market share of the largest cooperative, by the combined market share of the four largest cooperatives, and by the combined market share of all cooperatives. We experimented with these measures and with a cooperative Herfindal index. In all cases, there was little difference in the signs and t-ratios of the coefficients, suggesting that the various concentration measures were statistically equal. Consequently, we used, in most cases, the CR4 measure to parallel the CR4 measure for handlers discussed in the next paragraph. Only December values of cooperative market share were available and were assumed to hold for the entire year (see appendix for discussion of the computations).

USDA's Economic Research Service (ERS) furnished the December Class I sales of the four largest handlers in each order market. These sales figures, divided by December Class I use, determined handler CR4 measures. Class I use does not correspond exactly to Class I product sales because of interorder bulk and packaged milk transfers, but they are reasonably close. As with the cooperative CR4, we assumed the December values of the handler CR4 applied to each month of the calendar year.

A summary description of variables used, including those variables defined above plus some other encountered in the following discussion of estimation results, follows:

Variable name	*Description*
ADJMWP	Lagged first difference of the M-W manufacturing milk price series.
BALANCE	Indicator of balancing costs associated with monthly surpluses less than their annual average.
BUYERCR4	Handler four-firm market share, percentage of total Class I milk sales by largest four handlers.
COOPCR4	Cooperative four-firm market share, percentage of total producer deliveries by largest four cooperatives.
D1COST	First difference of direct milk production costs.
DIFF	Cooperative four-firm market share minus handler four-firm market share.
DOMAMPI	Dummy variable equal to 1 for those observations for which AMPI-southern region is the largest cooperative and does not compete with Mid-Am or DI.
DOMDI	Dummy variable equal to 1 for those observations for which DI is the largest cooperative and does not compete with AMPI or Mid-Am.
DOMMIDAM	Dummy variable equal to 1 for those observations for which Mid-Am is the largest cooperative and does not compete with AMPI or DI.

FEDDUM	Dummy variable equal to 1 for markets with a marketing agency in common serving as a bargaining agent for individual cooperatives.
FLUSH	Dummy variable equal to 1 for the months of April, May, and June.
LIMMIN	Cost of procuring Class I milk from Eau Claire or Albany minus the order minimum Class I price.
PREM	Over-order payment.
RATCHET	Deviation of current minimum Class I price from its previous maximum value.
SHAREDOM	Market share of largest cooperative.
SHORT	Dummy variable equal to 1 for the months of September, October, and November.

Econometric Analyses

The basic equation to be estimated expresses premiums, or over-order payments, as a function of:

- Cost of alternative milk supplies
- Stickiness of milk price in distributing and retailing
- Pricing imperfections because of using the lagged M-W price as the Class I price mover in Federal milk marketing orders
- Changes in the direct cost of producing milk
- Balancing costs in orders
- Degree of cooperative concentration in the market
- Degree of handler concentration in the market

Two significant groups of variables are involved, the first comprising factors such as general supply-demand conditions and cost of producing milk which might give rise to payments beyond the minimum Class I price, and the second comprising buyer and seller market concentration. The two market share variables are of primary interest in this study, and much of the discussion focuses on them.

The data were severely and unabashedly ransacked in search of appropriate empirical measures for the general variables listed above, for the proper functional form, and for the correct specification on the disturbance term. This *ad hoc*, empiricist approach was used for two interrelated reasons.

First, little theory exists on the specific issue at hand to identify the precise empirical definition of the variables, to suggest how the milk pricing process works itself out in the sense of specifying the functional form to estimate, and to cast up well-articulated hypotheses for testing. In addition, the previous research results summarized above are so mixed that they fail to offer concrete guidelines.

Second, if the hypothesis testing game were played correctly, only one equation containing the embedded hypotheses would be estimated. That is, lessons learned from a first round of estimations should not be used to reformulate things and then engage in a second round of estimations and hypothesis testing, and so on. This peeking at the data before hypothesis testing is not a valid procedure. (We prefer not to characterize what is done later as pretesting.) Because the data set at hand is unique to the variables available for analysis and to its time structure, we felt it worthwhile to learn as much as possible by passing through the data set several times. Each set of regression runs was typically modified based on results of previous runs. We use the standard statistical tests to assess these results, and the term "statistically significant" is often used in the following sections, even though this use is technically not valid.[9]

This regression strategy produced far too many estimated regression equations for this report. Yet, it is important to convey the flavor of what was done and the general nature of the results obtained. Con-

[9]Moreover, it is unlikely that the monthly observations are statistically independent, in which case the computed t-ratios understate the critical values for hypothesis testing.

sequently, this section presents a summary in which we try to provide a complete and honest treatment of all that was done, without at the same time swamping the reader with voluminous tables of regression coefficients. As an indication of the magnitude of the problem, consider that estimating one equation with six independent variables for each of 38 markets yields 266 regression coefficients, standard errors of these coefficients, and t-ratios to be evaluated. Experimenting with this same equation, say, changing the empirical measure of cooperative concentrations, yields 266 new regression coefficients, standard errors, and t-ratios. And, this comes from estimating only one basic equation with two alternative empirical definitions of only one independent variable. Hence, the need exists to summarize what was done.

To assist in summarizing the general regression strategy, this section is organized into four main subsections. The first treats the 96 monthly observations on each of 38 markets as a single data set with 3,648 observations. This pooling of the data implicitly assumes that the coefficients of the independent variables are constant across markets and over time. This was done in the spirit of getting a feel for the data and for experimenting with alternative model specifications. Two pooling methods are discussed. The first pools all 38 markets and experiments with such factors as market power measurements. The second pools subgroups of markets using disaggregated criteria, such as region and dummy variable coefficient shifters.

The second subsection presents a straightforward cross-section analysis, involving 95 regressions estimated across markets. This allows the coefficients to differ over time. Moreover, it highlights the effect on premiums of variables that change slowly, if at all, over time, but differ considerably across markets.

The third subsection involves combined cross-section and time-series estimation. This experimentation wrestles with the problem that some variables, such as market concentration variables, change slowly over time but vary dramatically across markets, while other variables, such as the M-W price, change substantially over time but little, if at all, across markets.

The final subsection experiments with equations estimated for individual markets. This analysis is restricted to only 24 of the original 38 markets. Because of the significant first-order autoregressiveness in the Ordinary Least Squares (OLS) residuals of the last equations, the Zellner procedure is used to obtain efficient estimates.

Pool All Observations

Table 3 contains results from estimating equations using the pooled data. These specifications include all 3,484 observations for which values were available for all variables.[10] The large number of degrees of freedom for these specifications results in a high probability of obtaining statistically significant coefficients. However, the assumption of constant coefficients implicit in this form of pooling is likely an incorrect specification. These pooled estimates, however, were useful for refining relationships subsequently estimated using possibly more appropriate statistical models.

Basic Equation. Equation 1 in table 3 includes the basic set of variables assumed to influence over-order premiums, with cooperative market power measured as the combined market share of the four leading cooperatives in each market. The coefficient of each variable had the expected sign and was statistically significant at the 1-percent level. The adjusted multiple correlation coefficient was small (0.33) and the standard error of the estimate (31 cents per cwt) was large relative to the average level of premiums (51.5 cents per cwt).

Alternative cost of fluid milk (LIMMIN) and order Class I price minus the previous maximum price (RATCHET) were the strongest explanatory variables based on t-ratios, followed by the lagged first difference in the M-W price (ADJMWP) and balancing costs expressed as a continuous variable (BALANCE). The relative strength of these variables tentatively suggests that competitive forces and pricing imperfections were more important than market power in explaining variability in premium levels. On the other hand, milk production cost (D1COST) was only weakly associated with premiums.

[10]The variable, ADJMWP, involves Class I price lagged 2 months, resulting in a loss of 76 observations. An additional 88 observations were lost because of missing premium data for New York-New Jersey, Eastern Colorado, and three Florida markets.

The coefficient on LIMMIN indicates that, all else constant, premiums increased by about 3 cents for a 10-cent increase in the cost of fluid milk imports from the cheaper of two sources. Premiums tended to reflect about 30 percent of the difference between order minimum Class I prices and their previous maximum price whenever the actual price fell below the previous high. Premiums changed by 19 cents for a lagged $1 change in the M-W price. A $1 change in the direct cost of milk production resulted in a 6-cent change in premiums in the same direction. Finally, a 1-percent decline in monthly fluid milk surplus below annual average levels tended to increase premiums by about 0.25 cent.

The coefficient on cooperative concentration indicates an increase in premiums of about 2.5 cents per cwt for a 10-percentage-point increase in the cooperative CR4. Stated differently, a market characterized by a CR4 of 100 would, all else constant, have an expected premium of 12.25 cents higher than a market with a CR4 of 50.

A 10-percentage-point increase in the fluid handler CR4 decreased premiums by about 1 cent per cwt. All else constant, a market with a handler CR4 of 100 would be expected to have a premium 5 cents lower than a market with a handler CR4 of 50.

Relative Market Power. In the base equation, COOPCR4 and BUYERCR4 are specified in a linear and additive fashion, implying that the effect on premiums of concentration on one side of the market is independent of the level of concentration on the other side of the market. As a crude measure of relative concentration, DIFF, defined as COOPCR4 minus BUYERCR4, was used. The base equation was re-estimated using DIFF in place of the two separate concentration variables (equation 2 in table 3). The coefficient of DIFF is positive and statistically significant. The other coefficients in the equation differ little from the base equation, and the overall fit of the model is identical. There is no statistical basis for selecting between these two formulations.

To test whether the market share of the largest cooperative might be more highly associated with premium than COOPCR4, we substituted SHAREDOM, market share of the largest cooperative, for COOPCR4 in equation 3. The coefficient of SHAREDOM is roughly one-half the size of the COOPCR4 coefficient in the base equation, reflecting the differences in the means of the two variables. Other coefficient values are approximately the same across the two equations. The correlation coefficient and the standard errors of the estimates are the same.

Based on this comparison, we concluded that essentially no difference exists between these alternative specifications of cooperative concentration. In most subsequent specifications, we use COOPCR4 because of its symmetry with BUYERCR4, our only measure of handler concentration.

Cooperative Federations. In some fluid milk markets, common marketing agencies composed of member cooperatives negotiate with handlers over prices and other terms of trade. For example, the Central Milk Producers Cooperative (CMPC) is a common bargaining agent for AMPI, Wisconsin Dairies Cooperative, Lake-to-Lake Dairy, Golden Guernsey, and several other cooperatives with fluid milk sales in the large Chicago regional order. Similar arrangements were in place within the southern Michigan and three Florida orders during the 1973-80 period (6).

Where such joint bargaining occurs, the market share of the federation is probably more important than the shares of the individual members in indicating likely seller market power. We do not have information on federation membership, or even on precisely which markets are involved in joint bargaining. We were able, then, to examine only a crude measure of the federation effect by using a dummy variable for the five markets known to have common bargaining agencies. In equation 4, the variable FEDDUM took on the value of one for Chicago, southern Michigan, upper Florida, Tampa Bay, and southeastern Florida, and zero otherwise.

The coefficient on FEDDUM (table 3) was positive and statistically significant, indicating about a 25-cent higher premium in the five markets, all else being constant. Other coefficient values were roughly the same as in the base equation, except for the buyer concentration variable coefficient, which was only about 10 percent as large as it was in the base equation and not statistically significant. The adjusted R^2 was only marginally higher, and the standard error of the estimate was 1 cent lower.

Table 3—Results of estimating selected aggregate pooled formulations[1]

Variable	Equation						
	Base 1	2	3	4	5	6	7
Constant	− 0.00266	0.11231	0.11379	0.03776	0.11756	− 0.01725	− 0.01193
LIMMIN	.28303 (29.0)[2]	.28954 (30.1)	.27960 (28.1)	.24422 (25.2)	.25403 (26.5)	.28592 (29.6)	.27866 (27.8)
RATCHET	− .30608 (− 28.8)	− .30887 (− 29.0)	− .30623 (− 28.7)	− .29635 (− 28.8)	− .30035 (− 29.2)	− .30495 (− 28.9)	− .30521 (− 28.6)
ADJMWP	.18737 (8.0)	.18571 (7.91)	.18571 (7.9)	.18512 (8.2)	.18296 (8.07)	.13638 (5.64)	.18860 (8.0)
D1COST	.06327 (3.31)	.06357 (3.32)	.06468 (3.37)	.06952 (3.8)	.06974 (3.76)	.04812 (2.50)	.06393 (3.34)
BALANCE	.25879 (7.45)	.27058 (7.80)	.26131 (7.50)	.26496 (7.91)	.28061 (8.38)		.25533 (7.33)
COOPCR4	.00245 (6.75)			.00211 (6.02)	.00272	.00259 (7.60)	(7.10)
BUYERCR4	− .00097 (3.74)		− .00089 (− 3.43)	− .00010 (− 0.45)		− .00095 (− 3.72)	− .00097 (− 3.71)
DIFF		.00139 (5.9)			.00070 (3.02)		
SHAREDOM			.00137 (5.77)				
FEDDUM				.25603 (16.32)	.24891 (15.86)		
FLUSH						− .03614 (− 2.8)	
SHORT						.12156 (9.1)	
DOMAMPI							.01556 (1.11)
DOMDI							.00327 (.214)
DOMMIDAM							− .14930 (− 3.21)
$\bar{R}^2$	.33	.33	.33	.38	.37	.34	.33
SEE	.31	.31	.31	.30	.30	.31	.31

[1]A blank indicates that the particular variable is not used in the equation.
[2]Numbers in parentheses are t-ratios.

FEDDUM is obviously an important factor in explaining the level of premiums, but the loss of significance of BUYERCR4 is disconcerting and not readily explainable. We subsequently re-estimated the equation by substituting DIFF for the independent buyer and seller concentration variables (equation 5). The coefficient on DIFF was significant, but its value was only one-half that in equation 2. Other coefficient values were approximately the same.

BALANCE versus Seasonal Dummies. Equation 6 tested the performance of the seasonal dummy variables relative to BALANCE in measuring the effect of balancing costs on premiums. The variable, FLUSH, had the value of one for April, May, and June; SHORT had the value of one for September, October, and November.

The coefficients of the seasonal dummy variables were significant and had the expected signs. Compared with the values for December-March and July-August, premiums were about 3.5 cents lower in the spring flush milk production season and 12 cents higher in the fall. The goodness of fit of equation 6 about matched the base equation.

Based on these results, we elected to use BALANCE as the measure of balancing costs in subsequent formulations. A continuous specification was more appealing. Also, we were concerned that the seasonal dummies might be measuring effects other than balancing costs.

Cooperative Dominance. Much discussion of cooperative market power has focused on the large regional dairy cooperatives which operate across several markets. Some argue that when one of these cooperatives operates isolated from the others, it tends to negotiate relatively large premiums.

To test this, we created three dummy variables which assumed values of 1 for markets within which either AMPI, DI, or Mid-Am was the largest cooperative and neither of the other cooperatives operated. We denoted these variables as DOMAMPI, DOMDI, and DOMMIDAM in equation 7, table 3.

Of the three coefficients, only the coefficient of DOMMIDAM was statistically significant, but it had an unexpected negative sign. This suggests that the three major regional cooperatives did not obtain consistently higher premiums which each operated independently of the other two.[11]

Interaction Analysis. Cooperative market power may not directly result in higher over-order premiums. The relationship between concentration and premiums may be connected by economic variables. For example, a strong cooperative might be more successful in negotiating a fluid milk price closer to the limit price as defined by the cost of milk from alternative sources. Such indirect manifestation of market power might be detected by using interaction variables.

We estimated four specifications, involving interaction of both COOPCR4 and SHAREDOM with the economic variables, both including and excluding FEDDUM, the federation dummy variable. These estimates yielded similar results. Those using SHAREDOM as the measure of cooperative concentration and including FEDDUM were as follows:

Variable	Coefficient value without interaction	Coefficient value with interaction
FEDDUM	0.26495[1]	0.52864[1] – 0.00417[1] x SHAREDOM
LIMMIN	.23672[1]	.09227[1] + .00222[1] x SHAREDOM
RATCHET	–.29467[1]	–.16417[1] – .00199[1] x SHAREDOM
BALANCE	.26262[1]	.50124[1] – .00310[1] x SHAREDOM
ADJMWP	.18399[1]	.00701 + .00254[1] x SHAREDOM
D1COST	.07149[1]	.04057 + .00042 x SHAREDOM
BUYERCR4	–.00009	.00187 [2]
SHAREDOM	.00149[1]	–.00024 [2]

[1]t-value greater than 2.0.
[2]No interaction with these variables.

In the interaction specification, both buyer and seller concentration variables had significant coefficients with perverse signs, while all of the interaction terms except those including D1COST had significant coefficients. The coefficients for FEDDUM suggest that a federation of individual cooperatives becomes less important in explaining premium levels the larger the market share of the largest cooperative.

[11]This, of course, assumes that they do operate independently. We have no way of knowing whether the regional cooperatives operate independently of each other or of handlers.

This makes intuitive sense in that the federation influence would likely be larger if the federation were composed of smaller cooperatives.

The BALANCE result, somewhat of an anomaly, showed that balancing costs were more strongly associated with premiums in markets with weaker cooperatives. This may be saying that stronger cooperatives are able to obtain premiums in excess of and unrelated to balancing costs.

The coefficients for LIMMIN, RATCHET, and ADJMWP were consistent with the argument that these economic variables were more strongly related to premiums in markets with stronger cooperatives. For example, the equation implies the following with regard to premiums associated with 50- and 100-percent market shares of the largest cooperative:

Variable	50-percent	100-percent
LIMMIN	0.203	0.314
RATCHET	-.264	-.363
ADJMWP	.134	.261

In other words, a cooperative with a 100-percent market share would be expected to obtain, as an over-order premium, 31 percent of the difference between a market's transportation cost-related limit price and the order minimum price compared with 20 percent for a cooperative with a 50-percent share. The values for RATCHET and ADJMWP are similarly interpreted.

Another interaction specification tested the argument that the number of cooperatives operating in a market is important in disciplining the behavior of the largest cooperative. This implies that the greater the number of cooperatives, the greater the opportunity for handlers to play one against the other, limiting the market power of the largest cooperative.

A variable, NCOOPS, was defined as the number of cooperatives operating in each market in December. NCOOPS took on the same value each month of the year as did the concentration variables. NCOOPS was included as a separate variable and as an interaction variable with SHAREDOM, along with the explanatory variables in the basic pooled equation.

Results failed to support the presumed relationship. The coefficient for NCOOPS was significantly positive, contrary to expectations. The interaction term coefficient was not significant. Coefficients on other variables did not change with inclusion of the new variables, nor did their inclusion increase the goodness of fit.

Summary of Pooled Analyses. The results obtained from pooling the data, assuming constant coefficients across markets and over time, were generally consistent with *a priori* expectations. Because of the different measurement units, it is difficult to rank the variables in terms of their importance in explaining variation in over-order premiums. Using t-ratios as a crude and not particularly acceptable criterion, the economic variables appear to be more significant than the market power variables.

There is some evidence that federations involved in joint bargaining can generate higher premiums. However, the interaction specification suggested that the effect of federations was weakened substantially in the presence of a large marketing cooperative. Unfortunately, the available data did not permit an adequate examination of the role of federations in obtaining over-order payments. Balancing costs can be an important determinant of premiums in the form of a cost for services provided by cooperatives. Although no obvious, easy way to measure these costs exists, the variable BALANCE seemed to do an adequate job. Considerable experimentation with the difficult task of empirically measuring market power suggested that COOPCR4 was as good as any variable, and this variable was used in all subsequent formulations.

Finally, in most formulations, the signs of COOPCR4 and BUYERCR4 agreed with expectations and were statistically significant (see table 3). The numerical value of the coefficients were quite insensitive to alternative formulations of the other variables included in the equation. However, these results were obtained from the strong assumption that the coefficients were constant across markets and over time, that is, that the same population regression equation is appropriate for each of the 38 markets. If this assumption is untenable, then the estimates are of questionable statistical validity, in which case caution should be exercised in placing an economic interpretation on the estimates.

Disaggregated Specifications

Because the assumption implicit in the aggregate pooled specification of constant coefficients across markets and over time may be untenable, we partially disaggregated the data and re-estimated equations to appraise the validity of that assumption. Results presented below generally support the proposition that the coefficients are not invariant across markets and over time.

Disaggregation by Region. The first criterion for disaggregation was region. Six regional groups were defined according to the following special characteristics: the Northeast, with relatively low over-order premiums; the three Florida markets, with relatively high premiums; the Chicago regional and southern Michigan markets, where premiums were negotiated by marketing agencies in common; markets where AMPI/southern region was the major bargaining cooperative; markets where DI was the major bargaining cooperative; and all other markets. The equations estimated for these six regions are presented in table 4.

The coefficients of the economic variables generally had the expected signs and were statistically significant, except in the Northeast equation. The coefficients of the market concentration variables exhibited a mixed pattern, as often positive as negative. In Northeast and DI regions, COOPCR4 was negative and statistically significant. Conversely, BUYERCR4 was positive in four regions and statistically significant in Florida. Moreover, the amount of variation in premiums explained by the independent variables ranged from a low of 25 percent in AMPI-southern region and all other markets to a high of only 50 percent in Chicago-southern Michigan.

The results in table 4 show clearly that the coefficient estimates vary considerably among regions. This is not surprising in the case of buyer and cooperative concentration, because these variables showed considerable regional variability. The same is true for LIMMIN and BALANCE. But the variables, RATCHET and ADJMWP, were nearly identical across markets.

Intercept and Slope Shifters. Dummy variables were used as the next form of disaggregation. The first equation allowed the intercept to vary among markets and over time. This specification assumed that the coefficients of the independent variables were the same among markets and over time. Because of an apparent time pattern in the intercept, the data were disaggregated into these time periods and the equation was re-estimated. The final and most general specifications used dummy variables to allow for shifts in both intercepts and coefficients across regions and over time.

Table 4—Results of estimating base equation for selected regions

Regional group	Valid N	Mean premium	Constant	LIMMIN	RATCHET	ADJMWP	BALANCE	D1COST	COOPCR4	BUYERCR4	$\bar{R}^2$
Northeast	224	0.160	0.07345	−0.03262	−0.28456*	−0.01047	0.46961*	0.09677	−0.00304*	0.00427	0.43
Florida	282	.924	−.22816	.38839*	−.62357*	.25902*	.70827*	.03619	−.00782	.01345*	.44
Chicago-So. Mich.	188	.630	1.05686	.49945*	−.38033*	.02169	.86041*	−.00481	.00801*	−.03175*	.51
AMPI-So. region	846	.55	−.61196	.27715*	−.27096*	.26281*	.10320	.12914	.00755*	.00058	.25
Dairymen, Inc.	564	.571	1.50670	.13467*	−.58245*	.06720	.47489*	.03279	−.01551*	.00001	.49
All other markets	1394	.406	.23506	.23555	−.16042*	.17035*	.19292*	.06048*	.00029	−.00092*	.25

*Indicates t-value for coefficient greater than 2.0.

The base equation for intercept shifts, shown below, uses Greater Kansas City as the base (omitted) market and 1973 as the base year:

$$
\begin{aligned}
\text{PREM} = -0.43292 &+ \underset{(5.95)}{0.1322\ \text{LIMMIN}} \\
&- \underset{(-30.39)}{0.37404\ \text{RATCHET}} \\
&+ \underset{(8.69)}{0.18388\ \text{ADJMWP}} \\
&- \underset{(-1.81)}{0.2980\ \text{D1COST}} \\
&+ \underset{(10.05)}{0.30012\ \text{BALANCE}} \\
&+ \underset{(6.42)}{0.00512\ \text{COOPCR4}} \\
&+ \underset{(1.98)}{0.0197\ \text{BUYERCR4}}
\end{aligned}
$$

where numbers in parentheses are t-ratios.

Some differences in coefficient values from the fully pooled model are meaningful (see table 3). LIMMIN was substantially reduced in importance, D1COST became negative and insignificant, and BUYERCR4 became positive and significant. Apparently, the variable, LIMMIN, picked up interorder premium differences in the full-pooled specifications that were not related to a market's distance from the Upper Midwest or the Northeast. D1COST may have picked up the trend in the full-pooled model, rendering its coefficient insignificant when annual dummies were included. Finally, the coefficient of buyer concentration was positive and statistically significant.

Seventeen of the 37 market intercept shift coefficients were not significantly different from zero. Five markets had significantly negative coefficients, indicating premiums below the (greater Kansas City) base. Three (Black Hills, eastern South Dakota, and Michigan Upper Peninsula) were small, isolated markets near areas of large milk surpluses. An explanation for low premiums in the other two markets, New Orleans-Mississippi and Mid-Atlantic, is less obvious.

Fifteen markets exhibited market intercept shift coefficients significantly greater than zero. In four markets, DI was the major cooperative (Tennessee Valley, Nashville, Louisville-Lexington-Evansville, and Georgia), and in two markets, it was AMPI-southern region (Lubbock-Plainview and Texas Panhandle). Common marketing agencies existed in five markets (Chicago Regional, southern Michigan, and three Florida markets). No readily apparent commonalities exist among the other four markets with positive intercept shift values (Upper Midwest, Ohio Valley, eastern Ohio-western Pennsylvania, and Indiana) except, possibly, location relative to the high-premium Chicago and southern Michigan markets.

For the year, dummy variables (1973 base), coefficients for 1974, and 1979-80 were significantly positive, and coefficients for 1975-78 were significantly negative. The coefficient values suggest three periods, 1973-74, 1975-78, and 1979-80; splitting the data set in this manner and re-estimating the base equation yielded the following:

Variable	Coefficient for—		
	1973-74	1975-78	1979-80
BALANCE	0.29054*	0.26627*	0.07879
LIMMIN	.93792*	.23532*	.29433*
D1COST	.03195	-.04006	-.95266
RATCHET	-.32217*	-.34767*	-.72068
ADJMWP	.34113*	.13956*	.35748*
BUYERCR4	-.00078	-.00062*	.00001
COOPCR4	.00212*	-.00011	.00369*
R^2	.60	.29	.42
SEE	.326	.260	.271
Mean of premium	.544	.428	.628

*t-value greater than 2.0.

The coefficients exhibited substantial variability across the three periods. Only LIMMIN and ADJMWP were significant in all three; D1COST was not significant in any. RATCHET, an important variable in explaining variation in premium levels during 1973-74 and 1975-78, was insignificant in 1979-80. Coefficients for the concentration variables were inconsistent in both sign and significance. In short, these results strongly imply that pooling over time is inappropriate because the coefficients seem to be unstable.

The stability of estimated coefficients was further explored by incorporating both slope and intercept shifters for years and two regions; where AMPI-southern region or DI were the major cooperatives (table 5). This prior regional grouping was necessary because the computer software did not permit slope shifters for all 38 markets.

The regional shift variables showed that the three regional specifications (AMPI-southern region markets, DI markets, and other markets) were quite different. In markets where AMPI-southern region and DI were the major cooperatives, the coefficients for LIMMIN and BALANCE were significantly smaller than in other markets. This is inconsistent with the premise that these major cooperatives were more capable of obtaining a limit price or recovering balancing costs. The coefficient on COOPCR4 was larger in AMPI-southern region markets than in other markets, but significantly negative in DI markets.

The yearly slope shifters indicated some possible time patterns in coefficient values. The coefficient for LIMMIN increased from 1973 to 1974, when it reached its maximum value of 1.07, then fell off, becoming negative in 1980. The coefficient for RATCHET was negative and fairly stable from 1974 to 1977 (all values of RATCHET were zero in 1973), but was positive, negative, and insignificant in 1978, 1979, and 1980, respectively. The effect of ADJMWP on premiums was strongly positive in 1973, but the slope shifter values rendered the effect insignificant from 1974 to 1977. From 1978 to 1980, the effect was positive but much smaller than in 1973. D1COST had a significant effect on premiums only in 1973 and BALANCE in 1975 and 1979.

For the concentration variables, yearly slope shifters showed that COOPCR4 was significantly positive and similarly important in the first 2 years and last 2 years of the period. For 1975-78, the value of the COOPCR4 coefficient was zero. BUYERCR4 was significant (with an *a priori* incorrect positive sign) only in 1980.

Summary of Disaggregated Specifications. The previous section ended with the caution that the results obtained from the fully pooled equations may not be valid because of the assumption underlying the estimates. This section supported that caution by showing that there is considerable variation in the regression coefficients among markets and over time. Of particular importance is the significant variation in the coefficients of the market concentration variables, especially COOPCR4, as shown in tables 4 and 5. The important lesson to be learned from this section is that the markets cannot be viewed as all alike with regard to how premiums respond to changes in the independent variables.

Cross-Sectional Specifications

In this section, the estimated equations treated each of the 96 months as a separate sample. This cross-section approach allowed the regression coefficients to change over time, while assuming that the coefficients were constant across markets. It further

Table 5—Results of estimating base equation with slope and intercept shifters for years and regions

Shift variable	Coefficient for—							
	Intercept	LIMMIN	RATCHET	ADJMWP	D1COST	BALANCE	COOPCR4	BUYERCR4
Base (1973-other markets)	−0.19964	0.37662	—	1.4344	0.40943	—	0.00325	—
AMPI-Southern Region	−.84656	−.14187	.10062	—	—	−.30149	.00094	—
DI	—	−.1830	−.1493	—	—	−.17541	−1.31431	.00154
1974	—	.69654	−.33234	−1.02922	−.44189	—	—	—
1975	—	.25758	−.33505	−1.31674	−.63199	.50215	−.00344	—
1976	.31413	−.15567	−.35854	−1.16502	−.42109	–	−.00402	—
1977	—	−.10799	−.24686	−1.24078	−.44969	—	−.00312	—
1978	.30204	−.16635	.31850	−.65806	−.39185	—	−.00332	—
1979	.22373	—	−1.06875	−.88903	−.44038	.30252	—	—
1980	—	−.51262	—	−.80979	−.50958	—	—	.00225

— = t-value less than 2.0.

assumed that the variables were important in explaining the variation in premium levels in a cross-section sense, that is, the variables were associated with differences in premiums across markets.

We estimated the equations using all the basis variables discussed above, except for RATCHET and ADJMWP, which were essentially constant across markets because of the basing point method of setting Class I prices. Because D1COST involved a 1-month lag, we estimated only 95 separate equations.

These estimates yielded unsatisfactory statistical results (table 6). Adjusted R^2 values averaged 0.28, and four were negative. In 34 cases, the F-values for the equation were insignificant at the 5-percent level. These instances all occurred in the specifications encompassing the period June 1975 to July 1979, during which only 16 of the 50 monthly equations possessed significant F-values.

LIMMIN appeared to be the only included variable that was consistently associated with differences in premiums across markets. The coefficient was significantly positive (t-value M 2.0) in 78 of 95 cases, and positive but insignificant in 16. Differences in coefficient values among equations closely mirrored differences in premiums.

Coefficients for BALANCE and D1COST were highly unstable, with values seemingly randomly distributed above and below zero. Only six BALANCE coefficients had t-values greater than 2.0, four positive and two negative. For D1COST, 11 coefficients were significant, five positive and six negative. Elimination of D1COST from the equations increased the adjusted R^2 value more than 65 percent of the time.

The coefficients for COOPCR4 and BUYERCR4 were significant in only seven and two cases, respectively. But, these coefficients were more consistent than those for D1COST and BALANCE, that is, they more often carried the expected sign, albeit insignificant, and some patterns over time were (vaguely) apparent. Between August 1973 and December 1975, 21 of the 29 COOPCR4 coefficients were positive, four with t-values exceeding 2.0. From June 1979 through December 1980, all of the 19 COOPCR4 coefficients were positive, three with t-values exceeding 2.0. Buyer concentration was more strongly associated with premium differences in the earlier period but not in the later. All BUYERCR4 coefficients were negative in the 25 equations for March 1974 through March 1976, but only two had t-values greater than 2.0.

As noted earlier, the period mid-1973 through late 1975 showed rapidly rising and falling premiums (see fig. 1). These results suggest that stronger cooperatives achieved higher premiums than their smaller counterparts during that period of generally high premiums in all markets. And, stronger buyers appeared capable of holding premiums down during that time. Beginning in mid-1979, premiums increased markedly, though less dramatically, than in 1973 and 1974. At the same time, premiums among markets became more closely associated with cooperative concentration ratios, though not with buyer concentration.

Combined Time-Series and Cross-Sectional Analysis

Some of the variables used in these previous analyses might be more related to changes in premiums over time than to differences among markets. For example, ADJMWP and RATCHET are constant across markets but vary considerably over time. Other variables, for example, the concentration variables, change slowly or not at all over time, but vary substantially among markets.

Two related subsets of explanatory variables were defined as time-series variables and cross-section variables. We first estimated regression equations for each of the 38 markets using time-series variables. Then, the computed monthly residuals were regressed against the cross-section variables. We then examined alternative categorizations of variables and reversal of the stages (cross-section estimates first). The effect of including FEDDUM, the dummy variable representing the presence in a market of a joint bargaining agency, was also tested.

The results of this two-stage estimation process were not instructive, regardless of formulation. The distribution of coefficient values for the 38 time-

Table 6—Results of estimating monthly cross-section equations

Year and month	LIMMIN	D1COST	BALANCE	COOPCR4	BUYERCR4	$\bar{R}^2$[1]	Mean of PREM
1973:							
February	0.44[2]	−	−	−	−	0.32	0.152
March	.43	−	−	−	−	.35	.150
April	.43	−	+	−	−	.30	.142
May	.52	0.22	−	−	+	.39	.167
June	.35	+	−	−	−	.32	.145
July	.44	+	+	−	−	.46	.194
August	1.24	−1.06	−	+	+	.58	.619
September	1.25	1.64	−0.94	−	−	.54	.631
October	1.50	+	−	+	+	.43	1.042
November	1.23	−	−	+	+	.54	.637
December	.48	+	−	−	+	.27	.321
1974:							
January	.57	+	+	+	−	.44	.370
February	.71	−	+	+	+	.34	.366
March	.64	+	−	−	−	.41	.387
April	1.07	+	−	+	−	.52	.423
May	.60	−	−	−	−	.46	.357
June	.72	+	−	+	−	.49	.532
July	.88	− .61	−	0.0068	−	.60	.697
August	1.05	+	−	.0133	−0.0058	.51	1.139
September	1.06	−	+	0.123	−	.50	1.173
October	1.22	− .59	+	0.126	−	.52	1.155
November	1.12	+	+	+	−	.51	1.005
December	1.43	+	−	+	− .0079	.49	1.004
1975:							
January	1.47	−	+	−	−	.44	1.048
February	1.45	+	−	+	−	.44	.946
March	.87	−	−	+	−	.30	.764
April	.72	−	−	+	−	.27	.745
May	.84	+	−	+	−	.23	.677
June	.58	−	+	−	−	.13X	.539
July	.48	+	−	−	−	.19	.531
August	.55	−	−	−	−	.19	.531
September	.533	+	.45	+	−	.54	.717
October	.37	+	.58	+	−	.31	.530
November	.31	− .67	−	+	−	.34	.426
December	.19	−	−	+	−	.07X	.292
1976:							
January	+	+	+	−	−	.05X	.229
February	+	+	+	−	−	.03X	.126
March	.14	+	+	−	−	.09X	.190
April	.31	−	−	+	+	.05X	.528
May	.17	+	+	−	−	.03X	.269
June	+	.26	−	+	−	− .04X	.360
July	+	−	−	+	−	− .07X	.455
August	−	+	+	−	+	− .15X	.370
September	+	−	+	−	−	− .06X	.309
October	0.34	−	−	−	−	.23	.304
November	.50	+	−	−	−	.16X	.457
December	.31	−	+	+	−	.20	.470

continued—

See footnotes at end of table.

Table 6—Results of estimating monthly cross-section equations—continued

Year and month	LIMMIN	D1COST	BALANCE	COOPCR4	BUYERCR4	$\bar{R}^2$[1]	Mean of PREM
1977:							
January	0.25	+	−	+	−	0.05X	0.436
February	+	−	−	+	−	.06X	.425
March	.22	0.67	−	+	+	.28	.449
April	.23	−	+	+	+	.08X	.466
May	.17	+	+	−	+	.04X	.349
June	+	− .15	+	+	−	.01X	.297
July	.26	− .38	−	+	−	.27	.321
August	.22	−	+	+	+	.11X	.361
September	.23	+	+	+	+	.23	.375
October	.28	.67	0.41	+	+	.42	.365
November	.25	−	+	+	−	.34	.316
December	.16	−	+	+	+	.26	.294
1978:							
January	+	+	+	−	+	.12X	.305
February	.13	−	−	−	+	.08X	.276
March	+	−	−	+	−	.01X	.261
April	+	1.31	−	+	+	.41	.324
May	+	+	−	−	+	.00X	.331
June	.13	−	−	−	+	.06X	.251
July	+	+	+	−	+	.04X	.329
August	+	−	.79	+	−	.27	.377
September	.34	−	+	+	+	.15X	.549
October	+	−	−	+	+	.05X	.477
November	.27	−	− .45	−	+	.32	.388
December	+	+	+	+	+	.06X	.464
1979:							
January	.21	−	−	−	+	.27	.309
February	.21	+	−	+	−	.10X	.422
March	.22	−	−	+	−	.16X	.478
April	.20	+	+	+	+	.11X	.495
May	.19	+	+	−	+	.11X	.441
June	+	−	−	+	+	.10X	.447
July	.14	−	−	+	+	.10X	.422
August	.30	−	+	0.0069	−	.36	.716
September	.32	+	−	+	+	.29	.731
October	.30	−	+	.0053	−	.35	.703
November	.36	−	−	+	−	.38	.717
December	.42	−	−	+	+	.43	.764
1980:							
January	.37	−	−	+	+	.50	.731
February	.36	+	−	+	−	.47	.698
March	.36	−	+	+	+	.56	.718
April	.26	+	−	+	+	.41	.777
May	.27	+	+	+	−	.38	.667
June	.16	− .38	−	+	+	.37	.602
July	.21	−	+	.0056	−	.41	.652
August	.33	−	+	+	−	.52	.676
September	.31	−	+	+	+	.47	.738
October	.42	−	−	+	+	.50	.720
November	.23	+	−	+	+	.40	.822
December	.24	−	+	+	+	.45	.632

[1]An "X" following adjusted R^2 value indicates F-value insignificant at the 5-percent level.

[2]A numerical entry indicates coefficient has t-value greater than 2.0. A + or − entry indicates the sign of coefficients with t-values less than 2.0.

series equations, using RATCHET. ADJMWP, BALANCE, and D1COST as time-series variables in the first stage and COOPCR4, BUYERCR4, and LIMMIN as cross-section variables in the second stage, is shown below:

Variable	Expected sign		Unexpected sign	
	Significant	Insignificant	Significant	Insignificant
RATCHET	28	2	1	7
ADJMWP	11	25	0	2
BALANCE	12	21	0	5
D1COST	9	25	0	4

Except for Class I price relative to its previous maximum value (RATCHET), the variables were weakly associated with month-to-month changes in premiums. Adjusted R^2 values averaged 0.25. Three equations had F-values which were insignificant at the 5-percent level. Durbin-Watson statistic values were predominantly in the 0.3 to 0.7 range, indicating strong serial correlation in the OLS residuals.

Results from the second stage (94 equations), which used residuals from the first stage as a dependent variable, were as follows:

Variable	Expected sign		Unexpected sign	
	Significant	Insignificant	Significant	Insignificant
LIMMIN	25	17	34	18
COOPCR4	13	32	3	46
BUYERCR4	0	45	0	49

Adjusted R^2 values for these equations were uniformly low, and 14 were negative. F-values were insignificant at the 5-percent level in nearly half (42) of the cases. The pattern of coefficients appeared random. The inclusion of FEDDUM in the second-stage equations improved the goodness of fit in more cases than not, but the signs of the FEDDUM coefficients were about equally positive and negative.

Other formulations exhibited similar ambiguity in the second-stage results. Given the *ad hoc* nature of the 2-stage estimation procedure, this is perhaps not too surprising. In any case, the results provide no additional insight into the relationship between over-order premiums and market power.

Time-Series Analysis: Individual Markets

OLS equations were initially fit to each of 36 markets separately, using the full set of independent variables previously discussed. Many formulations were estimated, differing by alternative empirical measures of the independent variables.

The pattern of the coefficients of cooperative concentration, the variable of major interest, across the 36 markets was independent of the specific concentration measure used. The results on this variable were generally ambiguous. The coefficient was seldom statistically significant in even half of the markets, and in many of these cases, the sign was negative, contrary to expectations. Moreover, there was no obvious pattern in the estimates among regional groupings or among groupings according to major regional cooperatives.

Stepwise regression was used to get a sense of the relative importance of each variable in explaining variation in premiums. On the basis of the beta-coefficients and order of entering the equation, RATCHET was the most important variable, followed closely by LIMMIN. These two variables entered the market equations first in all but five instances.

The concentration variables, BUYERCR4 and COOPCR4, were either insignificant or significant with the "wrong" sign in 22 markets. There were only five markets where the signs of both these coefficients were "correct" and statistically significant.

D1COST, included to allow for supply shifts, was extremely weak in that it did not enter the equation until at least three other variables had entered, and even then in only one-half of the market equations. In seven markets, the sign of D1COST was incorrect.

Based on a crude ranking of variables using the sequence of entry into the stepwise formulation and the expected sign of the coefficient, the relative importance of the variables was, in order: RATCHET, LIMMIN, ADJMWP, BALANCE, BUYERCR4, COOPCR4, and D1COST.

In five markets, the values of either COOPCR4 or the BUYERCR4 variables were constant at 100 percent over the entire time period, and coefficients could not, as a result, be estimated. In seven other markets, the values of one or both of these variables changes very little, often less than one percentage point. This lack of change made these variables of little worth, in effect funny dummies. Consequently, 12 of the original markets were dropped, and the analysis focused on the remaining 24 markets, using the following independent variables in all cases: BALANCE, LIMMIN, ADJMWP, RATCHET, COOPCR4, BUYERCR4.

The Durbin-Watson d-statistic revealed a positive first-order autoregressive, AR(1), residual pattern in each of the market-equations estimated in the previous section. An AR(12) specification was estimated because of the seasonality in monthly milk production and consumption. This turned out to be statistically nonsignificant and was dropped from the analysis.

The AR(1) coefficient was statistically significant in all the OLS equations, ranging in value from a low of 0.22 to a high of 0.83. This means that the OLS estimates were inefficient and, more seriously, the estimated variances of the coefficients were biased, likely downward, leading to rejecting the null hypothesis when it should be accepted.

As stated in earlier sections, prices in all Federal orders are driven by the M-W price series, and milk moves across markets in response to local market supply and demand conditions. Consequently, contemporaneous error terms on the equations will likely be correlated across markets because the respective market equations may be subject to the same set of random forces. If this is the case, then coefficient estimates for individual markets will be inefficient because the error correlation is not incorporated in the estimates of the variances.

Because of the significant first-order autoregressiveness in the OLS residuals, the variables for each market were transformed by their autoregressive coefficients before obtaining the Zellner estimates. The Zellner estimates allowed the estimated coefficients to vary across markets.

The OLS, autoregressions, and Zellner estimates are shown in appendix table 1. Only the Zellner estimates are discussed in this section (table 7).

BALANCE had the expected positive sign in 14 of the 24 markets and was statistically significant in six of these markets. LIMMIN was positive in all but four markets and was significant in 16 markets. It was significantly negative in Mid-Atlantic and Central Arkansas-Ft. Smith. ADJMWP was positive in 22 markets and statistically significant in 17 of these 22 markets. Finally, RATCHET was negative, as expected, and statistically significant in 22 of the 24 markets.

The control variables LIMMIN, ADJMWP, and RATCHET possessed the expected signs and were statistically significant in a large majority of the markets. While the results on BALANCE were inconclusive, the significant coefficients had the expected positive sign. The results for the control variables generally agreed with expectations.

Such was not the case with the market concentration variables. While the coefficient of COOPCR4 was positive, as expected, in 15 of the 24 markets, it was statistically significant in only four cases. In other words, the coefficient of COOPCR4 was not statistically significant and positive in 20 of the 24 markets analyzed. Moreover, the sign of the COOPCR4 was negative in nine markets, and statistically significant in two of those.

Similarly, the coefficient of BUYERCR4 was negative in 16 markets, but statistically significant in only 6 of them. Conversely, in five markets, the sign of BUYERCR4 was positive and statistically significant.

Finally, COOPCR4 had a significant positive coefficient and BUYERCR4 had a significant negative coefficient in only three markets: Chicago, southern Illinois, and Greater Kansas City. In one market, Greater Louisiana, the variables had significant but "wrong" signs.

Review of Analyses

As stated at the beginning of this section, the data were manipulated severely to try to force the "right" formulation. Clearly, the highly mixed results mean that conclusive findings are not possible, nor can defensible statements concerning the impact of cooperative behavior on the level of over-order payments be confidently made. Whatever the actual effect may be, it differs across markets and over time; one cannot lump all markets together and make a general statement about the issue at hand.

From an econometric standpoint, the seemingly unrelated regression discussed in the previous section is probably the "best" specification used because it allows for the coefficients of all variables to vary across markets, something the previous *ad hoc* procedures alluded to be the case. Because the AR(1) transformations corrected for the autoregressiveness in the OLS residuals, the estimates of the standard errors should be more efficient and, more important, unbiased. Additional efficiency of the estimates is obtained by taking advantage of the contemporaneous correlation in the OLS residuals across markets which arises because base prices in all markets are driven by M-W prices.

A weakness of the seemingly unrelated regression estimates above is the underlying assumption that the coefficients were constant during the time period of the analysis. This assumption was not supported by the results of the various *ad hoc* procedures discussed in earlier sections. The assumption of time invariance, however, had to be used because of size limitations imposed by the software used.

Premiums And Undue Price Enhancement

One policy question related to over-order premiums is whether they represent undue price enhancement under Capper-Volstead Section 2, which obligates the Secretary of Agriculture to initiate a cease and desist action against any agricultural marketing cooperative judged to have unduly enhanced price through monopolization or restraint of trade.

Table 7—Zellner estimates

Federal order markets	BALANCE	LIMMIN	ADJMWP	RATCHET	COOPCR4	BUYERCR4
New England	−0.01128	−0.0667	0.01232	−0.32885*	0.00707	−0.01492
Mid-Atlantic	.03177	−.08017*	.01422	−.10520*	.00182	−.00425
Chicago Regional	.43086*[1]	.82893*	.16073*	−.22780*	.01935*	−.02778*
Ohio Valley	−.00090	.28332*	.12568*	−.23205*	.00025	−.00212
Eastern Ohio-Western Pennsylvania	.12279	.08423	.03290	−.31564*	.01298	−.03896*
Southern Michigan	−.23625	.18384	.09213	−.35401*	.00465	−.00489
Indiana	.10983	.10544	.13228*	−.27205*	−.00862	.01279*
Louisville-Lexington-Evansville	−.00367	.20560*	.15092*	−.33925*	.00876	−.01548
Tennessee Valley	−.00447	.36397*	.17281*	−.39072*	.00333	−.00649*
Georgia	.12441*	.12044	.14480	−.32431*	−.00927	.01240*
Southern Illinois	.10902*	.66919*	.18163*	−.12702*	.01076*	−.01110*
Central Illinois	.02520	.75883*	.26328*	−.14896*	.00160*	−.00302*
St. Louis-Ozarks	−.07222	.56680*	.19544*	−.08871*	−.00023	.00061
Greater Kansas City	−.00166	.35480*	.24535*	−.13234*	.00044*	−.00455*
Nebraska-Western Iowa	−.00663	.24769*	.26449*	−.12429*	−.00573*	.00373*
Tampa Bay	.18727*	.33521*	.30170*	−.53496*	.01107	−.01129
Upper Florida	.18456*	.40548*	.31166*	−.49632*	−.00130	−.00105
Memphis	−.07885	−.12724	.19930*	−.12962	.00018	−.00019
Central Arkansas-Ft. Smith	.11590	−.24152*	.22935*	−.23734*	−.00613	.00981*
Lubbock-Plainview	.08995	.21905*	.21496*	−.30477*	.00316	−.00437
Upper Midwest	.01989	1.47094*	.13128*	.07309*	−.00255	.00232
Southeastern Florida	−.12816	.36882*	.42295*	−.46750*	.01000	−.01122
New Orleans-Mississippi	.10797	.02960	−.06920	−.61340*	−.00495	.00425
Greater Louisiana	.16866*	.18589*	−.61735*	−.02445*	−.02445*	.03020*

*Indicates t-ratios greater than 2.0.

Undue price enhancement has not been administratively or judicially defined. Capper-Volstead Section 2 has never been invoked by a Secretary of Agriculture since its inception in 1922. But, as noted earlier, some students of cooperative antitrust have characterized over-order premiums as *prima facie* evidence of undue price enhancement.

Jesse and Johnson addressed undue price enhancement in a general context and proposed a procedure for detecting Capper-Volstead Section 2 violations which involved a three-stage screening process (*13*). The first stage examined conventional market structure conditions, such as relative firm market shares, barriers to entry, and product differentiation.

Screening on these characteristics would yield a subset of cooperatives that could potentially exercise market power. But, many have recognized that the ability of cooperatives to elevate prices is constrained by their ability to control supply, something not usually faced by proprietary handlers who can tailor raw product acquisition to match desired output. This constraint on cooperative market power, however, may not be binding. Second-stage screening would focus on evidence that cooperatives could prevent their members from overproducing in the event market power was exercised. At least four such methods of surplus control exist: restricted membership, restricted member deliveries, surplus disposal via price discrimination, and organizational slack.

The final screening stage would examine performance; observed prices would be compared against a standard to determine whether or not prices were unduly enhanced. We use workable competition as a guideline in this process. Observed prices would be compared with what would prevail if the market was workably competitive. Ideally, this would involve identification of an actual market differing from the suspect market only in that it is judged to be workably competitive. Expected price relationships over time, form, and space would be used in the price comparisons.

In applying the initial stage of this screening process to cooperatives operating in fluid milk markets, the pervasiveness of Federal orders, along with the bulkiness of the product to be shipped, help to define relevant markets. Federal orders define marketing areas that are designed to include all competing fluid milk handlers. Regulated handlers are free to sell packaged products outside their marketing area and to purchase raw Grade A milk from producers located in another marketing area.[12] But, transportation cost considerations limit handlers' sales and procurement ranges, and raw milk purchases from unregulated areas or from handlers regulated under other orders are subject to down-allocation and compensatory payments.[13] Order marketing areas are reasonable proxies for relevant markets. Because product differentiation in fluid milk at the procurement level is negligible, first-stage screening of dairy cooperatives essentially involves identifying cooperatives with relatively large market shares within orders, either absolute or relative to handlers, along with a search for nonorder-related barriers to entry which might be erected by cooperatives.[14]

Dairy cooperatives do not normally restrict membership nor do they attempt to restrict member-milk deliveries. Most cooperatives, in fact, actively recruit new members from among independent producers and producers belonging to competing cooperatives. And cooperative marketing agreements typically guarantee an outlet for any and all production the member wishes to market. Organizational slack might be measured by examining cooperative margins, but separating costs from excess cost (beyond what is needed) would likely be impossible. Hence, second-stage screening of dairy cooperatives is limited to examining surplus disposal methods.

Surplus disposal, or providing for the manufacturing of Grade A milk not needed for fluid uses, is an important function of dairy cooperatives. Surplus disposal is a necessary part of balancing, but, at the same time, it may allow a cooperative to elevate fluid price, because a ready market exists for any production increase induced by higher blend prices.

[12]For example, many Wisconsin Grade A milk producers are pooled under the Indiana Federal order, while most handlers in Wisconsin are regulated under the Chicago or Upper Midwest orders.

[13]Down-allocation means that milk brought into a marketing order area from outside its boundaries must be allocated to the lower use classes to the greatest possible extent.

[14]Order-related barriers are important in exercising market power. However, cooperatives are not subject to antitrust prosecution for making use of these.

And marketing order classified pricing rules assure the separation of fluid and manufacturing milk markets, a prerequisite for effective surplus disposal.

The magnitude of Grade A surplus milk generated in a market must be assessed to appraise the surplus disposal role of dairy cooperatives. Extremely low utilization rates, for example, might suggest that blend prices have been too high. Of course, such an assessment must be made in light of marketing order actions concerning pricing and pooling requirements. In reality, it would be difficult to separate the causal factors leading to Grade A milk surpluses.

Potentially, then, dairy cooperatives with a large proportion of the milk regulated under a Federal order market may exercise limited market power. If elevated fluid milk prices elicit production increases, surplus fluid-eligible milk can be directed to manufactured uses. State laws and sanitary requirements prevent fluid handlers from obtaining their needs from any pool of manufactured (Grade B) milk within a market, and they face economic disincentives to obtaining milk from outside the market. Limits on the ability to exercise market power come from the ability of handlers to obtain milk from outside the cooperative, either from independent producers, other cooperatives, or from outside the order. Cooperatives that successfully exercise market power also risk inducing free-riding splinter cooperatives, which can benefit their members with higher pay prices than the cooperative handling the burden of diverting excess milk production.

The question of whether a cooperative may have monopolized or restrained trade is partly a legal question and, in any case, beyond the range of inquiry in this report. We can illustrate the screening process for evidence of undue price enhancement, however, by using our monthly data series. Premiums in suspect markets can be compared with those in markets judged to be workably competitive. Premiums in markets with a high cooperative market share, where Grade A surpluses are large and/or growing, can be compared with premiums in markets without a dominant cooperative where surpluses are small and/or relatively constant.

The 38 markets used in this study were ranked by average market share (percentage of total market Grade A deliveries) of the largest cooperative for 1976-80. These ranks appear in table 8 along with ranks by market for over-order premiums, surplus Grade A milk deliveries, and average change in Class I utilization from the corresponding month of the previous year.[15]

Arbitrarily selecting 50 and 75 percent as critical CR_1 values yielded 14 markets with large market shares (greater than 75 percent), 15 with medium (between 50 and 75 percent), and 9 with small (less than 50 percent).

Systematic first-stage screening flags the 14 cooperatives in the large share markets. Over-order premiums in these markets averaged 22 cents per cwt higher than in small-share markets. However, in 5 of the 14 large share markets, premiums were below the 38-market median (ranks below 20) in 1976-80, leaving 9 markets for further screening.

In screening on performance, the relevant question is whether the cooperatives with a high market share in markets with high premiums are exercising market power or pricing competitively. While an unequivocal answer to this question would require an indepth market-by-market analysis, one important factor is production relative to consumption. The 9 markets with higher than average premiums and cooperatives having a market share greater than 75 percent all have Grade A surpluses *less* than the 38-market median surplus. Eight of the nine had negative average surplus values, indicating that market Grade A milk supplies were less than necessary to meet Class I consumption and reserves. In 6 of the 9 markets, Class I utilization declined, on the average, from 1976 to 1980, and that decline exceeded the 38-market median in 4 markets. But, only Wichita showed a decline in utilization accompanied by a positive surplus.

[15]Grade A surplus is defined as deliveries in excess of Class I use plus a daily and seasonal reserve. Following Dobson and Buxton, we define daily reserve requirements as 25 percent of Class I use for the month, and seasonal reserve requirements as average daily deliveries for the year less average daily deliveries during the month of lowest deliveries expressed as a percentage of monthly Class I use (*10*).

Table 8—Ranking of 38 Federal order markets, by selected criteria, 1976-80[1]

Market	Rank based on—			
	Market share of largest cooperative	Over-order premium	Surplus	Change in Class I utilization, 1976-80
New York-New Jersey	1	4	35	14
Upper Midwest	2	14	38	4
Iowa	3	13	36	3
Southern Illinois	4	17	28	26
Chicago	5	33	37	8
Mid-Atlantic	6	1	31	6
Greater Louisiana	7	5	5	23
New England	8	2	29	15
Central Illinois	9	18.5	20	37
Average group rank	5.0	11.9	28.8	15.1
Eastern Ohio-Western Pennsylvania	10	8	26	16
New Orleans-Mississippi	11	3	12.5	35
Nebraska-Western Iowa	12	15	34	10
Ohio Valley	13	27	25	18
Red River Valley	14	6	11	36
Georgia	15	31	12.5	17
Southern Michigan	16	29	32	7
Indiana	17	30	17	29
Texas	18	7	15	33
Louisville-Lexington-Evansville	19	23	24	5
Paducah	20	22	9	30
Oklahoma-Metropolitan	21	26	16	21
Nashville	22	32	27	13
Tampa Bay	23	37	2	28
Michigan-Upper Peninsula	24	10	22	32
Average group rank	16.5	20.4	19.0	22
Neosho Valley	25	24	1	1
Eastern Colorado	26	11	18	34
Greater Kansas City	27	16	30	9
Upper Florida	28	38	4	22
Memphis	29	21	10	27
Tennessee Valley	30	25	14	12
Wichita	31	28	19	2
Lubbock-Plainview	32	34	6	25
St. Louis-Ozarks	33	18.5	21	11
Central Arkansas-Ft. Smith	34	20	8	19
Southeastern Florida	35	36	3	31
Eastern South Dakota	36	12	33	20
Texas Panhandle	37	35	7	24
Black Hills	38	9	23	38
Average group rank	31.5	23.4	14.0	19.6

[1]Ranking is from lowest to highest in all cases.

The largest Grade A surplus volumes occurred in markets with the lowest leading cooperative market shares. New York-New Jersey, Upper Midwest, Iowa, and Chicago ranked in the top five markets based on proportion of Grade A deliveries in excess of fluid needs.[16] These markets rank in the bottom five based on market share of the leading cooperative. Ironically, markets that display evidence of chronic overproduction do not appear suspicious when market shares of the leading cooperative are examined.

Our systematic screening procedure for detecting evidence of undue price enhancement appears to exonerate dairy cooperatives pricing fluid milk in Federal order markets. In fact, if a workably competitive market is defined in terms of supply/demand balance, then markets with a large leading cooperative share are more workably competitive than markets with more competition among cooperatives. And while stronger cooperatives tend to negotiate higher over-order premiums, these appear generally to be necessary to attract sufficient supplies of fluid milk.

Conclusions

This study focused on issues relating to over-order pricing of fluid milk in Federal order markets, especially the question of whether over-order pricing reflects the exercise of market power by dairy cooperatives or reflects market forces yielding competitive prices above order-administered minimum levels.

Our results strongly suggest that the complexities and dynamics of pricing in Federal milk market orders cannot be captured and measured by conventional regression analysis. None of the variables identified was consistently related strongly to premium levels; their importance in explaining premiums can be asserted to be strong, weak, nonexistent, or, in many cases contrary to expectations depending on which econometric specification, time period, or market grouping was chosen. We conclude that more powerful theories of pricing in such complex markets involving marketing cooperatives are needed before the questions of cooperative market power can be properly examined.

[16]Note, however, that a marketing agency in common with the Chicago market makes individual cooperative shares less important in determining market power.

Do Premiums Reflect Market Forces?

Cooperative balancing costs and milk production costs affect the position of fluid milk supply curves. If administered order minimum prices do not change with changes in these costs, then premiums might result. The cost of alternative fluid milk supplies measures the cost of imported milk in regions of the country that periodically experience inadequate local supplies. In surplus areas, this variable measures transportation costs from supply sources, which may not be fully covered by order transportation allowances. In many cases, an increase in the cost of procurement would be expected to increase premiums to the extent the cost increase is not reflected in administered prices.

The hypothesized positive relationship between changes in the direct costs of milk production (D1COST) and changes in premiums was not generally observed in the estimated equations. In those formulations where the variable is significant, it appears to be serving as a proxy for a trend. We therefore conclude that premiums are not a cooperative response to rapidly changing feed costs.

The lack of a significant relationship between direct production costs and premiums is not surprising in light of the manner in which Class I prices are set. The dairy price support program strongly influenced the M-W price over much of 1973-80. And, the parity prices used to set support levels were, in turn, influenced by production costs. Support prices did lag rapid cost increases in late 1973, when grain prices skyrocketed. But, at the same time, tight milk supplies resulted in sharp increases in the M-W price, and, consequently, Class I prices. Thus, administered price increases generally mirrored production cost increases.

We measured balancing costs in terms of monthly Grade A milk surpluses relative to annual average. The variable, BALANCE, assumed a value of zero if Grade A deliveries less Class I use was less than, or equal to, its annual average, and increased monotonically as supplies tightened relative to demand. The hypothesized positive relationship between BALANCE and premium levels was observed in most formulations, but the relationship was very weak. We attribute this more to our inability to measure balancing costs properly than to a genuine absence of causality. Our measure may bear little relationship to the actual form of balancing costs. Cooperative service charges for balancing, for example, may be set uniformly over the year rather than altered seasonally in response to actual costs incurred. In any case, we believe that the nature and form of cooperative balancing costs and their relationship to over-order premiums are complex issues that require and merit considerably more attention than received here. More work along the lines of (8) and (14) is needed.

The cost of obtaining fluid milk from one of two major surplus regions (zoned Class I price plus estimated freight) less the order minimum price was strongly correlated with over-order premiums in most of the specifications we estimated. This result is consistent with results obtained by the Capper-Volstead Committee and by Babb and Bessler (4). The interpretation of this result is not completely straightforward. Increased premiums coincident with increased milk transportation costs could reflect competitive forces or limit pricing. Looking just at regression parameters does not permit a distinction.

Interaction formulations suggested that cooperatives with large market shares are capable of obtaining over-order prices closer to alternative cost limits than cooperatives with smaller shares. But, regardless of leading cooperative market share, effective Class I prices fell far short of alternative cost limits on average. Moreover, markets with high cooperative concentration ratios are usually deficit in fluid milk production, and would thus be expected to have higher premiums to encourage large supplies.

On net, it appears that the relationship between premiums and the cost of procuring fluid milk from areas of large surpluses represents competitive pricing. The persuasive evidence underlying this conclusion is the rigidity of order Class I differentials, which do change in response to changing interorder differences in the availability of local fluid milk supplies. Markets with chronic or temporary shortages would be expected to exhibit prices in excess of order minimum prices. Differentials are not changed in response to increasing intra- or inter-order transportation cost. So, even in large surplus markets serving as sources of reserve supplies, order minimum prices may be inadequate to move milk to consumption centers.

Do Premiums Reflect Pricing Imperfections?

Two variables were used to measure the effect on over-order premiums of lags associated with price discovery in fluid milk markets. ADJMWP, the lagged first difference in the M-W price series, was included to recognize that M-W price changes are known before they affect order class prices. So, part of a forthcoming major change in administered price might be negotiated via a current premium change. The variable, RATCHET, is the amount by which current Class I price falls short of its previous maximum value. Its hypothesized effect on premiums is attributable to "sticky" fluid milk prices at the distributor and retail level because handlers might hold prices in the face of temporary declines in minimum Class I prices.

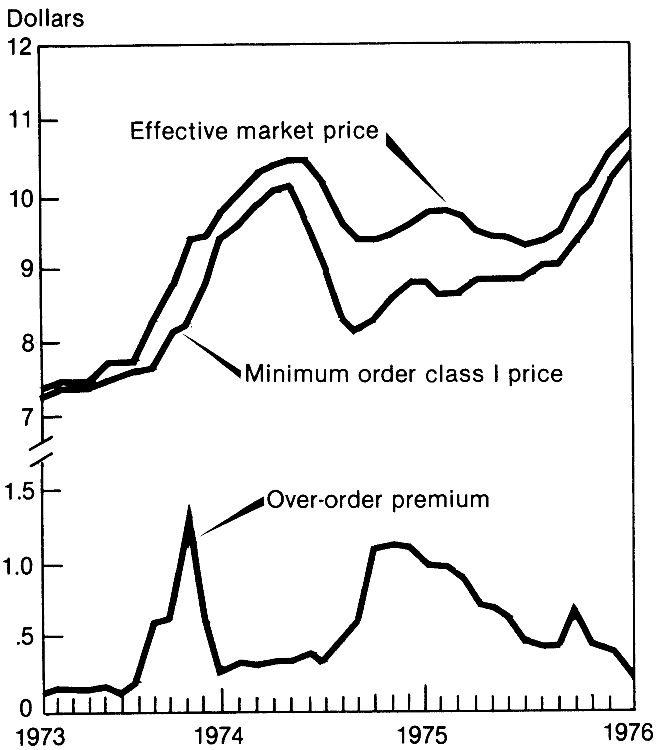
With few exceptions, the specifications that included ADJMWP indicated that premium changes resulted in effective Class I prices that preceded administered price changes. Judged on the basis of beta-coefficients, the effect was fairly uniform over time and markets. Interaction analysis demonstrated that the premium change associated with a given change in ADJMWP was larger in markets with larger cooperative market shares.

We conclude, therefore, that cooperatives are usually capable of obtaining part of an administered price increase before it becomes effective and that this capability is related to the market share of the cooperatives. To the extent administered price changes reflect competitive market conditions, we believe this *ex ante* adjustment is a comparable competitive reaction.

Judged by measures of simple and partial correlation, RATCHET is the strongest of the variables hypothesized to influence over-order premiums. The results show clearly that cooperatives are able to buffer administered price drops by enlarging premiums. Moreover, this ability appears positively related to cooperative market share. However, we are concerned that the observed relationship between premium and RATCHET may be more of a historical quirk than a general phenomena. The elevation of premiums coincident with falling order Class I prices is most apparent during the period mid-1974 through mid-1975, following an unprecedented 3-month drop in Class I prices of nearly $2 per cwt (see fig. 3). Nonzero values of RATCHET existed for 17 months (June 1974 through October

Figure 3

Federal Milk Market Prices and Premiums, Simple Average, Including 38 Markets, 1973-75



1975) with the average value equal to -\$1.22 (order minimum Class I price \$1.22 under its previous maximum value). Over-order premiums for the same 17 months (sample average for all markets) averaged 81 cents. In comparison, 1973-80 average monthly values for RATCHET and over-order premiums were -37 cents and 51 cents, respectively. The June 1974-October 1974 average differed from these overall means by -1.7 and +0.8 standard deviations, respectively.

The only comparable timespan during which order prices fell chronically below their previous maximum was the 26 months from March 1976 through April 1978. RATCHET averaged -52 cents over that period, 0.3 standard deviation below the 1973-80 mean. Premiums averaged 36 cents, 0.4 standard deviation *below* the mean. Apparently, cooperatives were not able to hold effective prices during this latter period.

Results of some of the estimates verify the unique nature of the RATCHET-premium relationship during 1974 and 1975. In the specification splitting the data by year groupings, the coefficient for RATCHET was insignificant in the 1978-80 period. The specification using slope dummies showed a similar result.

We concur with the Capper-Volstead Committee report, which described the mid-1974 to mid-1975 period as abnormal in terms of the combination of conditions favorable to cooperatives obtaining unusually high premiums (6, pp. 17-27). And, we suspect that the variable, RATCHET, serves as a proxy for a congeries of factors influencing premiums.

Do Premiums Reflect Market Power?

We explored the possible effect on over-order premiums of fluid milk seller and buyer power by including measures of cooperative and handler concentration. Cooperative concentration was hypothesized to be positively related to premium levels, and handler concentration was negatively related.

The relationship between handler concentration and premiums measured in numerous specifications was, at best, weak and more often insignificant or contrary to expectations. In part, this result comes from the deficiencies in measuring buyer market power. Assuming that December CR_4 values apply throughout the year is obviously questionable and has statistical implications as well. And, the identity of buyers may be more important in determining market power than their market share. But, within the constraints imposed by imperfect measurement, we conclude that differences in handler CR_4 had little to do with premium levels over the markets and time period we examined.

Measures of cooperative market power are subject to some of the same criticisms as measures of handler market power. And the relationship between cooperative CR_4 and over-order premiums is nearly as weak as that between handler CR_4 and premiums. More specifically, we conclude that, adjusted for other factors, there is no strong, consistent relationship between the market share of leading cooperatives in fluid milk markets and the level of premiums cooperatives are able to negotiate.

We are uneasy with this conclusion because it is a generalization that likely does not apply to all markets or to all time periods. We do not believe that all cooperatives are incapable of charging prices that exceed competitive levels. But, the procedures and data we employed do not permit us to isolate examples of such pricing behavior.

We note that there is a significant simple correlation between cooperative concentration and over-order premiums. For the most part, high premium/ high cooperative share markets are small markets, having utilization rates, located some distance from areas of large surplus. The high observed premiums in these markets have not resulted in burgeoning surpluses. In fact, the high premiums would appear to be needed to attract adequate supplies of fluid milk. We see little reason for concern about monopolization in these cases.

On the other hand, we are concerned about the incidence of premiums in markets with large and growing Grade A surpluses. If an excess supply of fluid-grade milk is apparent, then inducing even larger surpluses through over-order pricing is blatantly inefficient. Surpluses are largest in the Northeast, the Midwest, and the Plains States. Generally, premiums in these markets are relatively small and, in many cases, probably inadequate to cover cooperative costs of providing marketwide services. An exception is Chicago, where high premiums seem to be inconsistent with the massive surpluses in that market. However, much of the Grade A milk supply for Chicago comes from 200-400 miles from the city and, at least during the early 1980's, nearly all of the Chicago over-order premium has been dissipated by transportation credits to handlers.

In markets with inordinately large surpluses, high Class I differentials appear to be more responsible than premiums for providing plant incentives to be pooled and producer incentives to be converted from Grade B to Grade A. An evaluation of the efficiency-versus-equity dilemma inherent in determining pool eligibility is well beyond the scope of this study. But, if the purpose of milk marketing orders is to service adequately the fluid market, and if Class I differentials are to remain fixed, then a reassessment of interorder alignment of differentials seems imperative.

The existence of a common market agency of individual cooperatives appears to be more important than individual cooperative market shares in determining premium levels. However, our analysis of the effect of such federations was too aggregative to permit detailed conclusions. A useful extension of this study would be a more comprehensive appraisal of the nature of federations and their effect on premiums.

If there is one overall conclusion to this study, it is not that fluid milk markets are operating competitively, but, rather, that our statistical procedures applied to the data available do not support the hypothesis that over-order pricing is *consistently* related to buyer or seller market power. Others may legitimately conclude otherwise who are willing to accept the assumptions of a particular model specification or are looking at a specific period of time. But, a preponderance of evidence linking market power and premiums is certainly lacking.

References

(1) Babb, E.M. *Milk Marketing Services Provided by Cooperative and Proprietary Firms*. Stat. Bull. No. 279. Dept. Agr. Econ., Purdue Univ., West Lafayette, Ind., May 1980.

(2) ________. *Intermarket Milk Price Relationships*. Res. Bull. No. 760, Agr. Exp. Sta., Purdue Univ., West Lafayette, Ind., Jan. 1963.

(3) Babb, E.M., D.E. Banker, and G.E. Nelson. *Price Relationships Among Federal Milk Marketing Orders*. Stat. Bull. No. 146. Dept. Agr. Econ., Purdue Univ., West Lafayette, Ind., Nov. 1976.

(4) Babb, E.M., and D.A. Bessler. *Factors Affecting Over-Order Payments in Federal Milk Marketing Orders, 1965-80*. Stat. Bull. No. 977. Dept. Agr. Econ., Purdue Univ., West Lafayette, Ind., Nov. 1982.

(5) Babb, E.M., D.A. Bessler, and J.W. Pheasant. *Analysis of Over-Order Payments in Federal Milk Marketing Orders*. Stat. Bull. No. 235. Dept. Agr. Econ., Purdue Univ., West Lafayette, Ind., Aug. 1979.

(6) Capper-Volstead Committee. *The Question of Undue Price Enhancement by Milk Cooperatives*. Unnumbered publications. U.S. Dept. Agr., Dec. 1976.

(7) Capponi, Silvio. "Milk Marketing Price Premiums Reflect Added Services Costs," *Farmer Cooperatives*. U.S. Dept. Agr., Agr. Coop. Serv., Dec. 1982, pp. 9-13.

(8) Christensen, R.A., D.E. Petterson, and A.H. Swainston. *The Function and Cost of Market Milk Reserves and Balancing Supply with Demand*. Study Paper 79-8, Economics Research Institute, Utah State Univ., Logan, Sept. 1979.

(9) Cook, H.L., and others. *The Dairy Subsector of American Agriculture: Organization and Vertical Coordination*. NC Project 117, Monograph No. 5, College of Agr. and Life Sciences, Univ. of Wisconsin, Madison, Nov. 1978.

(10) Dobson, W.D., and B.M. Buxton. *Analysis of the Effects of Federal Milk Orders on the Economic Performance of U.S. Milk Markets*. Res. Bull. R2897, College of Agr. and Life Sciences, Univ., of Wisconsin, Madison, Oct. 1977.

(11) Graf, T.F. "Critique of Peter Hutt's Paper on Undue Price Enhancement." *Proceedings*, Conference on Milk Prices and The Market System, Community Nutrition Institute, Washington, D.C., Dec. 1975.

(12) Hutt, Peter B. "Undue Price Enhancement." *Proceedings*, Conference on Milk Prices and the Market System, Community Nutrition Institute, Washington, D.C., Dec. 1975.

(13) Jesse, E.V., and A.C. Johnson, Jr. "Defining and Identifying Undue Price Enhancement," *Antitrust Treatment of Agricultural Marketing Cooperatives*. NC Project 117, Monograph No. 15, College of Agr. and Life Sciences, Univ. of Wisconsin, Madison, Sept. 1983.

(14) Lasley, F.A., and L.G. Sleight. *Balancing Supply With Demand for Fluid Milk Markets—A Cost Comparison*. ESCS Staff Report. U.S. Dept. of Agr., Econ., Stat., Coops. Serv., Oct. 1979.

(15) MacAvoy, Paul W. (ed.) *Federal Milk Marketing Orders and Price Supports*. American Enterprise Institute Studies in Government Regulation, Washington, D.C., 1977.

(16) Manchester, Alden C. *The Public Role in the Dairy Economy*, Boulder, Colo.: Westview Press, 1983.

(17) Masson, R.T., and P.M. Eisenstat. "Welfare Impacts of Milk Orders and the Antitrust Immunities for Cooperatives," *Am. Jour. of Agr. Econ*. Vol. 62, No. 2, May 1980, pp. 270-278.

(18) Masson, A., R.T. Masson, and B.C. Harris. "Cooperatives and Marketing Orders," *Agricultural Cooperatives and the Public Interest*. NC Project 117, Monograph No. 4, College of Agr. and Life Sciences, Univ. of Wisconsin, Madison, Sept. 1978.

(19) U.S. Department of Agriculture, Agricultural Marketing Service. *The Federal Milk Marketing Order Program*. Mktg. Bull. No. 27, June 1981.

Appendix[1]

The data series for the following variables came from the annual USDA-AMS statistical bulletin, *Federal Milk Order Market Statistics:*

- Class I milk receipts, 1,000 lbs (RECEIPTS)
- Number of producers delivering milk (PRODNUM)
- Blend price, dollars/cwt (PRICE)
- Class I price, dollars/cwt (PRICE1)
- Class II price, dollars/cwt (PRICE2)
- Class III price, dollars/cwt (PRICE3)
- Total milk receipts, 1,000 lbs (TOTMILK)

Monthly values were recorded for each of the Federal milk order markets east of and including the Eastern Colorado market order for the period January 1973 through December 1980.

Unpublished USDA Data on Over-Order Charges

USDA furnished unpublished data for this study on estimated marketwide over-order charges on milk used in Class I, by market order, by month. These data represent the weighted average of all over-order charges in dollars/cwt in each market order spread over 100 percent of the Class I producer milk in that market. Premiums are not distinguished from service charges, and in a few markets, over-order payments come completely or in part from State milk order pricing. Among the 38 market orders considered, USDA reported that four had State milk-pricing regulations in effect in areas within their borders which accounted for at least part of their over-order premium during 1973-80. The four orders were Tennessee Valley, eastern Ohio-western Pennsylvania, Greater Louisiana, and Upper Midwest. The USDA data set used here provided no indication of just how much of any particular month's premium might be ascribed to such State regulation in these orders.

[1]Much of this section was written by Robert Combs, Project Associate, Dept. of Agricultural Economics, Univ. of Wisconsin, Madison.

Data Transformations

The over-order charge variable and the other eight variables listed above were used to produce eight more variables, the formulas for which follow:

$$1)\ \text{EQVTPRO} = \frac{\text{TOTMILK} \times 1{,}000}{\text{DELIVERY} \times \text{DM}^{2}}$$

Federal milk order market administrators use EQVTPRO (equivalent full-time producers) to calculate average daily delivery for a month in a market order, a figure which did not necessarily equal PRODNUM. Methods used in calculating average daily delivery per producer (DELIVERY) are left in part to the discretion of administrators. The total amount of milk delivered monthly to regulated handlers in each market is known. Therefore, we used the producer figures as divisors in arriving at the average daily delivery per producer, which is the element left to the discretion of the administrator. In some cases, the number of producers delivering milk on the market at any time during the month (PRODNUM above) is used. In other cases, however, administrators may use a more complicated method to arrive at this divisor, such as counting a producer delivering on the market for 10 days as one-third of one equivalent full-time producer. In any case, EQVTPRO was only used to combine average delivery figures for groups of orders where mergers during 1973-80 required combining data series. (See the subsequent section entitled "Combining Series in Case of Merger.")

$$2)\ \text{TOTOVORD} = \text{PREM} \times \text{RECEIPTS} \times 10$$

This is the total dollars paid in the market in the month as over-order charges.

$$3)\ \text{TOTRECTS} = \text{PRICE} \times \text{TOTMILK} \times 10$$

This is the total order dollars paid in the market in the month, that is, the blend price multiplied by the total number of hundredweight sold.

[2]DM is number of days in the month.

4) CLIRECTS = PRICE1 x RECEIPTS x 10

This is the total Class I dollars paid in the market in the month, that is, Class I price multiplied by the Class I milk sold.

5) CLIOANDP = PRICE1 + MKTOVCHG

This is the actual average price paid for Class I milk in the market in the month, that is, the Class I price plus the marketwide average Class I over-order charge.

6) $\text{CLIUTILZ} = \dfrac{\text{RECEIPTS}}{\text{TOTMILK}} \times 100$

This is the Class I utilization rate stated as a percentage.

7) $\text{TOTDYDEL} = \dfrac{\text{TOTMILK} \times 1000}{\text{DM}}$

This is the average daily delivery of all milk to regulated handlers in the market, stated in pounds.

8) $\text{CLIDYUSE} = \dfrac{\text{RECEIPTS} \times 1000}{\text{DM}}$

This is the average daily delivery of milk to regulated handlers used for Class I purposes in the market, stated in pounds.

Market Share Data

The Dairy Division of AMS furnished unpublished data on the number of producers belonging to, and milk marketed by, coopertive associations in Federal order markets. These data indicate the number of producers belonging to, and the milk marketed by, each cooperative for each marketing order as of December of each year. For 1973 and 1974, only producer numbers were available. Nonmember producer numbers and milk marketings were also available in this data set. The cooperatives were not identified by name, making positive identification of a particular cooperative impossible. This, in turn, made calculation of cooperative federation market shares impossible.

The raw market share data produced 14 variables used in further analysis. A short explanation of each of these derived variables follows:

1) COOPROD = a summation of the producer memberships for all cooperatives in a given market for a given year.

2) TOTPROD = a summation of all producers (cooperative and nonmember) for a given market for a given year.

3) $\text{MSNCOOPS} = \dfrac{\text{COOPROD}}{\text{TOTPROD}} \times 100$

= members of all cooperatives as a percentage of all producers, by market, by year.

4) MSNNON = 100 - NSMCOOPS = nonmembers as a percentage of all producers, by market, by year.

5) MSNDC = members of the cooperative with the largest membership as a percentage of all producers, by market, by year.

6) MSNCR4 = four-firm concentration ratio, that is, the summation of the memberships of the four cooperatives with the largest memberships as a percentage of all producers, by market, by year.

7) MSNHERF = Herfindahl Index,

$$\sum_{i=1}^{n} \frac{(\text{producer members in coop}_i)^2}{\text{total of all producers}},$$

by market, by year.

8) TOTMILK = a summation of all market milk sales, by market, by year.

9) COOPMILK = total milk sales of all cooperatives, by market, by year.

10) $\text{MSMCOOPS} = \dfrac{\text{COOPMILK}}{\text{TOTMILK}} \times 100,$

by market, by year.

11) MSMNON = 100 - MSMCOOPS, by market, by year.

12) MSMDC = milk sales of the cooperative with the largest sales as a percentage of total market sales, by market, by year.

13) MSMCR4 = four-firm concentration ratio, that is, the milk sales of the four cooperatives with the largest sales as a percentage of the total market sales, by market, by year.

14) MSMHERF = Herfindahl Index,

$$\sum_{i=1}^{n} \frac{(\text{milk sales by coop}_i)^2}{\text{market milk sales}}, \text{ by market, by year.}$$

The market share variables used in this analysis were based on member numbers for 1973 and 1974, and member-production for 1975-80.

Cost of Production Data

Under mandate of the Agriculture and Consumer Protection Act of 1973, the Secretary of Agriculture is directed to conduct periodic cost-of-production studies of various agricultural commodities, including milk. The 1979 milk cost-of-production study used a survey of 2,091 producers from 25 States as a primary source of information. ERS provided these raw data for this study. We deleted 316 records because they were from States without Federal milk market orders (California, Maine, and North Carolina) or States west of the Eastern Colorado Federal market order, such as Washington, which served as the western cutoff point for this analysis.

The USDA survey did not attempt to identify producers with the markets to which they might deliver milk, so we assumed that a farm located within a Federal milk order market would deliver to that market. Any record from a county that did not fall within the defined boundaries of a Federal order was deleted. Additional records were deleted because of incomplete reporting, leaving 1,441 cases.

The survey collected data on 848 different variables, only a few of which were required for this research. The following is a list of the variables extracted from the survey results:

- HAY = pounds of hay fed per cwt of milk
- HAYSIL = pounds of hay silage fed per cwt of milk
- CORNSIL = pounds of corn silage fed per cwt of milk
- OTHFORS = pounds of other forages fed per cwt of milk
- OPLABOR = operator labor hours per cwt of milk
- FAMLABOR = unpaid family labor hours per cwt of milk
- HIRLABOR = hired labor hours per cwt of milk
- HAULCOST = hauling costs per cwt of milk
- NCOWS = number of cows on farm
- TOTMILK = total milk production for farm
- OTHCOSTS = sum of six costs (deflated by prices paid index from *Ag. Prices*):

  marketing costs

  breeding fees

  veterinary costs

  cattle-hauling costs

  dairy supplies costs

  DHIA fees

- ADJFAC =

$$\frac{\text{actual number of cows on farm}}{\text{previously estimated number of cows on farm}}$$

The factor, ADJFAC, adjusted the statistical weight, given the results of each survey respondent. Respondents were selected using sampling intervals calculated on the basis of estimated number of cows of farms. Weighting the results by this adjustment factor makes use of more accurate cow numbers as reported by the farmers themselves.

After each State's summary statistics were calculated we combined figures from the various States identified with each order. Differing sampling intervals had been used to select the samples in each State, so the responses in different States represented differing numbers of cows. Thus, the sampling intervals used were applied as weights to assure that the cost figures from the various combined States would represent equivalent numbers of cows.

Feed Costs Per Cow Per Day

Monthly State feed prices used to calculate feed costs came from *Agricultural Prices*. Prices were collected for oats, corn, sorghum, barley, soybean meal (44-percent protein), commercially mixed dairy feed (16-percent protein), and hay (all hay).

The total amount of grain and other concentrates fed daily per cow (in pounds) and the percentage of that total represented by each of the various feeds was taken from *Milk Production*, available on an annual basis, by State.

In many States, at least some portion of the feed ration was made of something other than oats, corn, sorghum, barley, soybean meal, and commercially mixed dairy feed. This other-feed category included such products as cottonseed meal, wheat-bran shorts, alfalfa meal or pellets, and orange pulp, and generally represented from 1 to 10 percent of the feed ration depending on the availability of other feeds at competitive prices. Rather than attempting to develop price series for these minor feed categories, we priced the total of the other-feeds category on the assumption that it would command a price competitive with the rest of the feed ration, exclusive of the commercially mixed feed category. This involved increasing the weight of each of the other feed categories by its proportional share of the other-feed weight. We applied prices to these new weights to arrive at the feed cost. The following is the formulation used to calculate revised weights:

$$W1 = W2 + \frac{W2}{W3} \times W4,$$

where:

W1 = revised weight for each of five feed categories (oats, corn, sorghum, barley, soybean meal).

W2 = weight for each of the five feed categories as collected from *Milk Production*.

W3 = the sum of the weights of these five feed categories as collected from *Milk Production*.

W4 = the weight of the total feed ration minus commercially mixed dairy feed and W3.

Labor Costs

Labor costs were calculated from labor-hours-employed figures taken from the USDA survey of 1979 costs. Wage rates were taken from issues of *Farm Labor*. These monthly farm labor wage rates were then applied to the 1979 labor hours used (on the assumption that labor hours used had not changed over the period) to arrive at a monthly labor cost per cow per day over the 1973-80 period for each State.

Forage Costs

The forage cost per cow per day, like the labor cost per cow per day, was calculated under the assumption that the average weight of forages consumed daily by each cow did not vary greatly over the time period. The average forage consumption per cow per day was taken from the USDA dairy farm cost survey for 1979.

For each respondent, this forage consumption figure contained four elements: hay, hay silage, corn silage, and other forages. The hay equivalent of the amount in each category was combined into one forage category using the following conversion factors:

hay equivalent weight	=	hay weight x 1.00
		hay silage weight x 0.50
		corn silage weight x 0.33
		other forages weight x 0.33

We applied the State's monthly average price for all hay to this forage quantity to obtain monthly cost per cow per day for forages.

Other Direct Costs

These costs were available in the USDA dairy farm cost survey for 1979. The Index of Prices Paid (1977 = 100) was used to deflate these costs throughout the period.

Conversion from State to Market

Feed, labor, forage, and other direct costs were calculated for States and converted to a marketing order basis. Weights used in this conversion were the proportions of total market milk accounted for by each State shipping to that market. These proportions are published annually in special articles to the monthly *Federal Milk Order Market Statistics.*

Changes in the Number and Size of Market Orders, 1973-80

Several changes in Federal order markets occurred during 1973-80. Six market order mergers occurred involving a total of 21 previously independent orders. Another order expanded to include previously unregulated areas, and yet another order expanded to include the area for which still another order had terminated early in 1973. These changes necessitated a merging of the data from the combined orders to provide a consistent record for each of the orders resulting from these changes.

In 1980 a total of 47 Federal order markets for milk existed in the United States with 39 of these east of (and including) the Eastern Colorado market. Of these 39 markets, 29 represented no problems in terms of data collection because they experienced no merger activity during 1973-80. The other 10 markets required some data manipulation to produce a consistent data series.

The Central Arkansas, and Fort Smith, Arkansas, orders, while never merged, presented a problem in data collection because data for Fort Smith were often combined with that for Central Arkansas to avoid disclosure problems. Because separation of the orders was not possible in these instances, the two orders were treated as a single order for purposes of this analysis.

Market expansions affected the Greater Louisiana and New Orleans-Mississippi orders. In the case of Greater Louisiana, the Northern Louisiana market order expanded into the previously unregulated areas of Louisiana as of April 1, 1976. No previous order had covered this new area, so variables such as producer numbers and milk quantities show jumps as of the April 1, 1976, expansion date.

The expansion of the New Orleans order that created the New Orleans-Mississippi order as of April 1, 1976, presented a somewhat different problem. The integrated Mississippi area had previously been under a Federal order area until April 30, 1973. Consequently, the resulting combined data series exhibits two lumps, one at the April-May 1973 juncture where Mississippi data were no longer available and the other at the March-April 1976 expansion date where data for the entire area were again available.

The remaining six orders for which combinations of data series from merged orders were necessary, along with the orders that were merged to produce them and the merger dates, follow:

Regions	*Merger of*	*Date*
Southern Michigan	Southern Michigan Upstate Michigan	April 1, 1973
Texas	Austin-Waco Central West Texas Corpus Christi North Texas San Antonio South Texas	July 1, 1975

New England	Boston regional Connecticut	April 1, 1976
Upper Midwest	Duluth-Superior Minneapolis-St. Paul Minnesota-North Dakota Southeastern Minnesota-northern Iowa	June 1, 1976
Tennessee Valley	Appalachian Chattanooga Knoxville	October 1, 1976
Iowa	Cedar Rapids-Iowa City Des Moines North central Iowa Quad Cities-Dubuque	May 1, 1977

Eleven of the variables employed in this analysis required combining across merged markets. The methods used in performing these combinations follow:

(1) Class I milk receipts, 1,000 lbs $= R_{new} =$

$\sum_{i=1}^{n} R_i$ where:

R_{new} = Class I milk receipts in the newly created market,

R_i = Class I milk receipts in the $_i$th order merged to form the new order.

(2) Number of producers $= N_{new} = \sum_{i=1}^{n} N_i$

(3) Total milk receipts, 1,000 lbs $= T_{new} = \sum_{i=1}^{n} T_i$.

(4) Blend price, dollars/cwt $= B_{new} = \sum_{i=1}^{n} B_i T_i / T_{new}$.

(5) Class I price, dollars/cwt =

$$Pl_{new} = \sum_{i=1}^{n} Pl_i R_i / R_{new}.$$

(6) Over-order premium, dollars/cwt =

$$M_{new} = \sum_{i=1}^{n} M_i R_i / R_{new}.$$

(7) Average daily delivery per producer =

$$D_{new} = T_{new} / \sum_{i=1}^{n} T_i D_i.$$

(Note that T_iD_i equals the equivalent full-time producer figure discussed earlier.)

(8) Number of members in each cooperative =

$$X_{jnew} \sum_{i=1}^{n} X_{ji}.$$

For j cooperatives, (also for nonmember totals), in i orders merged, (that is, X_{jnew} equals the number of members of cooperative j, in the merged order.)

(9) Amount of milk from each cooperative =

$$Y_{jnew} = \sum_{i=1}^{n} Y_{ji}.$$

(10) and (11) Class I and Class II prices: these figures were not calculated using systematic formulas, such as those used in (1) through (9) above. Applicable prices and rationale for selection follow:

(a) Southern Michigan: Premerger Class II price = Southern Michigan Class II price. The Southern Michigan Class II price and the Upstate Michigan Class II price were equal in the period before the merger, so it made no difference which was used here. Premerger Class III price = Southern Michigan Class III price. While the Southern Michigan and Upstate Michigan Class III prices were not equal in the period before merger the choice of the Southern Michigan Class III price as representative of the whole of the merged market for the period was justified on the grounds that nearly all the Class III milk in the two markets combined was in the Southern Michigan market in the premerger period.

(b) Texas: Premerger Class II price = simple average of South Texas and North Texas Class II prices. The simple average of the North Texas and South Texas order Class II prices were used because these two orders accounted for 80 to 90 percent of the non-Class I milk delivered in the six orders merged to form the Texas order, and these two showed about equal amounts of non-Class I milk. Premerger Class III price = simple average of Class III prices from all six merged orders. The South Texas and North Texas orders had incomplete Class III price series but where prices appeared, they equaled the average of those of the other four merged orders. Thus, the simple average price was used for each date in the series, calculated over as many prices from the six orders as were available for each date.

(c) New England: Premerger Class II price = Boston Class II price and Premerger Class III price = Boston Class III price. The Boston regional and Connecticut orders had equivalent price series for Class II and also for Class III prices so it made no difference which series was chosen to complete the New England series back to January 1973.

(d) Upper Midwest: Premerger Class II price = Minneapolis-St. Paul Class II price and Premerger Class III price = Minneapolis-St. Paul Class III price. The Minneapolis-St. Paul Class II price series equaled that for the other orders merged to form the Upper Midwest order except for Duluth-Superior. The Duluth-Superior order accounted for a very minor part of the total non-Class I milk marketed in the Upper Midwest area, so the great majority of the Class II milk for the whole area would have been priced at the Minneapolis-St. Paul price. The Minneapolis-St. Paul Class III price was used for the premerger Upper Midwest Class III series, but the price series from any of the four orders merged into the Upper Midwest order would have served as well since they are all equivalent for Class III milk in the period of interest.

(e) Tennessee Valley: Premerger Class II price = Chattanooga Class II price and Premerger Class III price = Chattanooga Class II price. The Chattanooga price series for Class II and Class III prices were used because they equaled the Knoxville Class II and Class III series, and these two orders accounted for approximately 80 to 90 percent of the non-Class I sales in the area that was to become the Tennessee Valley order. The Class II price for the Appalachian order (the third of the three orders merged to form Tennessee Valley) applied to only about 20 percent of the non-Class I milk in the area, and the Appalachian order had no Class III price series for the period.

(f) Iowa: Premerger Class II price = Des Moines Class II price and Premerger Class III price = Des Moines Class III price. All four of the orders, merged to form the Iowa order, had the same Class II prices and Class III prices over the January 1973-through-May 1, 1973, period, so it made no difference which order's series was used.

(g) Central Arkansas-Fort Smith: The Central Arkansas Class II and Class III price series were used for this combined market with the following justifications: 1) Fort Smith Class II and Class II price series were incomplete, 2) the Fort Smith prices, where available, varied above and below the Central Arkansas prices by only about 1 cent per cwt, and 3) Fort Smith Class II and Class III prices were applied to very little milk because Fort Smith had very little non-Class I milk during 1973-80.

Alternative Milk Costs

The cost of procuring Class I milk from outside of an order was calculated as the Class I price in one of two orders with large supplies of Grade A milk beyond local fluid requirements (Chicago and New York-New Jersey) plus the cost of transportation to the receiving market. Eau Claire and Albany were used as pricing points within the Chicago and New York-New Jersey orders. The Eau Claire zone differential was constant at -36 cents per cwt during 1973-80, while the Albany zone differential was -15.6 cents through October 1977, and -23.4 cents thereafter. These differentials were subtracted from the reported order Class I prices to obtain base zone prices net of freight.

Highway mileages from major cities within each order to Eau Claire and Albany came from Rand McNally's *Mileage Guide for Household Goods Carriers*.

Transportation costs per mile were calculated by updating data from Harold W. Lough, *Truck Transportation Costs of Bulk Milk*, AGERS-33, Economic Research Service, U.S. Dept. of Agriculture, Aug. 1977. The Lough study synthesized fixed and variable costs for 1976. These were updated by applying monthly index values (April 1976 = 100) to decomposed cost components weighted by their individual contribution to total fixed or variable costs.

Components, weights, and related indexes for fixed costs were as follows:

Component	*Weight*[1]	*Index*[2]
Depreciation (buildings)	0.028	Building and fencing
License, highway taxes, and miscellaneous taxes	.114	Taxes
Return on assets	.277	Interest
Office salaries	.231	Wages
Insurance and administrative costs	.350	Consumer Price Index
	1.000	

[1]Proportion of total annual cost per truck. See Lough, table 3.
[2]SRS components from *Index of Prices Paid by Farmers*.

Variable cost components, weights, and indexes were:

Component	*Weight*[1]	*Index*[2]
Truck depreciation	0.176	Autos and trucks
Driver wages	.420	Wages
Fuel	.192	Fuel and energy
Maintenance, repairs, tires	.191	Motor supplies
Miscellaneous	.021	Consumer Price Index
	1.000	

[1]Proportion of total cost per mile. Depreciation and wages varied slightly by mileage; weights shown are averages for 500 to 1,500 miles. See Lough, tables 8 and 10.
[2]SRS components from *Index of Prices Paid by Farmers*.

Using Lough's base equation for April 1976,

$$Y = 0.767 + 0.00218X,$$

where Y is milk transportation costs in dollars per cwt and X is one-way mileage, and base zone Class I prices, monthly alternative milk costs for each market from each of the pricing points, were calculated. The variable, LIMMIN, was then defined as the smaller of the two values less the market Class I price.

As an alternative indicator of order Class I price misalignment, we created a variable, RESIDUAL, which corresponds to Babb and Bessler's Class I price deviation (4). The value of RESIDUAL was calculated as the residual from the cross-sectional regression of minimum order Class I prices on distance from Eau Claire for each month during 1973-80.

According to Babb and Bessler:

> Class I price deviations do not assume that the Upper Midwest is the only source of alternative milk supplies or that there is a single base point for pricing in the Upper Midwest. The deviations from regression measure differences in expected and minimum Class I prices among nearby orders, and thus assume that processors will seek nearby alternative sources of milk. . . price deviations thus measure alternative milk costs from nearby sources on a relative basis.

Although we were not entirely clear on the rationale for using RESIDUAL as a measure of local alternative milk cost, we did experiment with its use as an alternative for LIMMIN. Results were similar. We subsequently elected to use exclusively LIMMIN as an indicator of alternative costs, mainly because of its more intuitive justification.

Appendix table 1—Results of OLS, autoregressive, and Zellner estimates of time series relationships, 24 markets

Market	Procedure	$\bar{R}^2$	AR(1)[1] Rho	BALANCE	LIMMIN	ADJMWP	RATCHET	COOPCR4	BUYERCR4
New England	OLS	0.69		0.44184*	0.17964	0.00807	−0.45544*	0.01386*	0.02647
	AR(1)		0.749*	.20252	.23108	−.04583	−.39136*	.01161	.00204
	ZELLNER			−.01128	−.06677	.01232	−.32885*	.00707	−.01492
Mid-Atlantic	OLS	.71		.13099	−.09579*	.03298	−.14896*	.01288*	.00743*
	AR(1)		.558*	.07088	−.07777	−.00719	−.12768*	.00885*	.00521
	ZELLNER			.03177	.08017*	.01422	−.10520*	.00182	−.00425
Upper Florida	OLS	.67		.62156*	.85418*	.33606*	−.68724*	−.01788*	−.04265*
	AR(1)		.503*	.49718*	.72659*	.16807	−.62179*	−.01378	−.03057
	ZELLER			.18456*	.40548*	.31166*	−.49632*	.00130	−.00105
Georgia	OLS	.59		.54062*	.14531	.02662	−.36146*	.00682	.02605
	AR(1)		.412*	.42054*	.20372	.02650	−.35606*	.01218	.01927
	ZELLNER			.12441*	.12044	.14480	.32431*	−.00927	.01240*
Tennessee Valley	OLS	.70		.32529*	.59334*	.04130	−.42195*	.00774	−.01431*
	AR(1)		.466*	.25095*	.49670*	.5642	−.41955*	.00254	−.01212*
	ZELLNER			−.00447	.36397*	.17281*	−.39072*	.00333	−.00649*
Tampa Bay	OLS	.67		.73274*	.57575*	.02334	−.62678*	.10571*	.04306
	AR(1)		.544*	.35079	.52279*	.13774	−.60388*	.07610*	.03437
	ZELLNER			.18727*	.33521*	.30170*	−.53496*	.01107	−.01129
Southeastern Florida	OLS	.45		.26897	.58503*	.27445	−.71988*	−.06344*	−.03101
	AR(1)		.622*	.06843	.49132*	.29453	−.55790*	−.02497	−.02521
	ZELLNER			−.12816	.36882*	.42295*	−.46750*	.01000	−.01122
Chicago regional	OLS	.65		1.03737*	1.4292*	0.9277	−.25944*	.04646*	−.03123*
	AR(1)		.398*	.97191*	1.36590*	.06493	−.24838*	.04604*	−.03161*
	ZELLNER			.43086*	.82893*	.16073*	−.22780*	.01935*	.02778*
Southern Illinois	OLS	.73		.24224*	.77808*	.15268*	−.11887*	.01314*	−.02105*
	AR(1)		.214*	.25374*	.75642*	.14546*	−.12440*	.01323*	−.01935*
	ZELLNER			.10902*	.66919*	.18163*	−.12702*	.01076*	−.01110*
Ohio Valley	OLS	.56		.37982*	.40157*	.06884	−.30171*	.00626*	−.01180*
	AR(1)		.532*	.24381	.40414*	.05798	−.28048*	.00328	−.00974
	ZELLNER			−.00090	.29332*	.12568*	−.23205*	.00025	−.00212
Eastern Ohio-Western Pennsylvania	OLS	.73		.45799*	.31634*	−.00773	−.38663*	.01474	−.09412*
	AR(1)		.446*	.41686*	.27552*	.05934	−.37402*	.01754	−.07596*
	ZELLNER			.12279	.08423	.03290	−.31564*	.01298*	−.03896*
Southern Michigan	OLS	.64		.07826	.26510*	−.04426	−.38299*	.10622*	−.02537*
	AR(1)		.635*	−.15955	.23734*	.04559	−.36281*	.09582	−.01683*
	ZELLNER			−.23625	.18384	.09213	−.35401*	.00465	−.00489

See footnotes at end of table.

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Appendix table 1—Results of OLS, autoregressive, and Zellner estimates of time series relationships, 24 markets—continued

Market	Procedure	$\bar{R}^2$	AR(1)[1] Rho	BALANCE	LIMMIN	ADJMWP	RATCHET	COOPCR4	BUYERCR4
Louisv.-Lex.-Evans.	OLS	0.69		0.29330*	0.24583	0.04758	−0.34261*	−0.02618	−0.04188*
	AR(1)		0.211*	.23947	.25340	.04455	−.34321*	−.02105	−.03895*
	ZELLNER			−.00367	.20560*	.15092*	−.33925*	.00876	−.01548*
Indiana	OLS	.46		.38261*	.00545	.04496	−.32748*	.01865	.03116*
	AR(1)		.411*	.34976	.07364	.04440	−.31276*	−.00811	.02133
	ZELLNER			.10983	.10544	.13228*	−.27205*	−.00862	.01279*
Central Illinois	OLS	.55		.17614	.96351*	.26553*	−.17635*	−.00055	−.00912*
	AR(1)		.422*	.19505	.91604*	.22364*	−.18628*	−.00234	−.00690
	ZELLER			.02520	.75883*	.26328*	−.14896*	.00160	−.00302*
St. Louis-Ozarks	OLS	.58		.05980	.54409*	.19164*	−.08446*	.00465	.00167
	AR(1)		.449*	−.08517	.52566*	.16777*	−.11084*	.00930	−.00146
	ZELLNER			.07222	.56880*	.19544*	.08871*	−.00023	.00061
Greater Kansas City	OLS	.42		.03483	.53114*	.29187*	−.09814*	−.01506*	.00983*
	AR(1)		.353*	.05786	.51071*	.21799*	−.12412*	−.00846	−.01040*
	ZELLNER			−.00166	.35480*	.24635*	−.13234*	.00044	−.00455*
Nebraska-Western Iowa	OLS	.41		.21211	.70600*	.21292*	−.16119*	.02467*	.01528*
	AR(1)		.331*	.25971	.69924*	.19584*	−.17215*	.02292*	.01384*
	ZELLNER			−.00663	.24769*	.26449*	−.12429*	−.00573*	.00373*
Upper Midwest	OLS	.62		.13556	1.76330*	.11259*	.07227*	.00526	.00148
	AR(1)		.251*	.12051	1.77558*	.09568*	.06957*	.00578	.00169
	ZELLNER			.01989	1.47074*	.131279*	.07309*	−.00255	.00232
New Orleans-Mississippi	OLS	.60		.26972	.30498*	.19021	−.67677*	−.05326*	−.01531*
	AR(1)		.828*	.20340*	.12031	−.10309	−.61064*	−.00882	.00105
	ZELLNER			.10797	.02960	−.06920	−.61340*	−.00495	.00425
Greater Louisiana	OLS	.83		.50501*	.39769*	−.05178	−.65012*	−.03122*	.06203*
	AR(1)		.734*	−.12757	.09403	.13111	−.22698*	.02104	.01354
	ZELLNER			−.07885	−.12724	.19930*	−.12962	.00018	−.00019
Memphis	OLS	.22		−.23288	.15405	.20528	−.14837*	.00876	.03323*
	AR(1)		.734*	−.12757	.09403	.13111	−.22698*	.02104	.01354
	ZELLNER			−.07885	−.12724	.19930*	−.12962	.00018	−.00019
Central Arkansas-Ft. Smith	OLS	.57		.38491*	−.06478	.27790*	−.35258*	.06343*	.03395*
	AR(1)		.461*	.23386	−.06291	.11518	−.34191*	.06343*	.03395*
	ZELLNER			.11590*	−.24152*	.22935*	−.23734*	−.00613	.00981*
Lubbock-Plainview	OLS	.51		.27282*	.32802*	.25572*	−.42949*	.03482*	−.00955
	AR(1)		.577*	.04207	.34947*	.12817	−.39020*	.02737*	−.00300
	ZELLNER			.08995	.21905*	.21496*	−.30477*	.00316	−.00437

[1]Applies only to autoregressive procedure.
*Indicates t-statistics greater than 1.96.

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